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DRIVING THE GAS ENGINE TO THE WALL.

The contest for supremacy between the electric motor and the internal-combustion engine is a constant challenge to the alert central-station power solicitor. It is surprising that so few users of power on a small scale really appreciate the fine points of competition by means of which the electric motor carries the day, until some central-station man with a loose-leaf book full of facts and arguments gets a chance to talk business. As the use of electricity increases in all kinds of industries, the peculiar advantages of such service appear more and more marked, and in spite of the recurrence of old and well known benefits, new points of view become available in relation to the competitive success of the electric motor. Some of these aspects of the gas, gasoline and oil-engine situation are worth emphasizing at this time, in the interest of the widening field of central-station service.

With proper care, a gasoline engine, with a rating of from 5 to 50 horsepower may be expected to produce a horsepower-hour while in operation under favorable conditions at a fuel cost of from 1.5 to 2 cents. The actual cost of power is made up of many other factors, however, such as extra attendance, repairs, cleaning, inspection, value of floor space required, value of production lost if the engine fails even for a short period, fire risk, decreased flexibility of application, incidental losses in transmission, relative first cost and annual charges. These points have a money value, and the time is not far distant when it will be expressed more generally in figures in dealing with specific cases. If the analysis is carried far enough, many factors ordinarily listed under general conditions can be evaluated.

An explosion engine capable of affording a given output will rarely weigh less than twice as much as a motor of corresponding rating and in the larger sizes may weigh four or five times as much. The floor space required will usually be from two to four times as much for the engine, and the cubic space required by the motor will ordinarily be from one-third to one-quarter that demanded by the engine. With very little trouble, a power solicitor may keep his notebook up-to-date along this line, tabulating for quick reference the comparative weight, price, floor space, speed, volume, clearances in height, breadth and length and relative characteristics per horsepower output for each type of motive power. Such material forms a magazine of reserve ammuni-

tion of the greatest value in cases where acute competition exists between motors and engines, and when properly used enables the solicitor to attack the problem in a thoroughly scientific way. More and more it is necessary to work with refinement in meeting close competition, and there is no question that in the future many incidental advantages of electric power service will be capitalized, and fairly so.

In marshalling data on behalf of the electric motor, it is important to emphasize the point that the internal-combustion engine is rigidly limited with reference to its location. It cannot be attached to the wall or ceiling with any success, cannot be direct-connected to a machine tool or other irregularly shaped appliance with anything like practical results, and in almost all cases is forced to drive its work through a belt, with increased space demands. It requires a more expensive foundation than the motor, and must be located where both water and fuel can be supplied with ease. The relative cost of piping and wiring is worth looking into, as is also the comparative fire risk of the engine and the motor. Insurance companies have reduced the estimation of premiums in industrial plants to a system of highly scientific classification, and the additional cost per hundred dollars of valuation is very closely affected by apparently trifling changes in the conditions of building design and installation. In fighting through a closely contested power case it will pay to ascertain for the particular conditions what will be the increased cost of insurance resulting from the use of the engine. Under normal conditions there is no spark and only negligible heat about a motor, whereas with the engine, there must be a hot tube, spark or its equivalent, and at all times there is present not only an exceedingly inflammable gas or vapor, but in the case of the gasoline engine, a very inflammable liquid of extreme mobility, which makes it difficult to prevent leakage from pipes, tanks or valves. The simplicity of the motor cannot be gainsaid, and the relative cost of maintenance, cleaning, adjustment, replacement of parts, convenience of starting from a distance and on the spot, freedom from danger to employees, and variable-speed characteristics are all on the side of electricity. When the cost of a shut-down is considered—and this can be figured in each plant with reasonable accuracy—and when the expense of labor required for operating and maintaining the equipment is added, the prospective power purchaser is generally willing to listen with greater interest to the claims of the electric motor. It is rare to find a motor out of service more than five or six hours a year, compared with from three days to a week in the case of the internal-combustion engine.

Space will not permit the inclusion of all the principal points of superiority of the electric motor, but among those which are often overlooked are the necessity of skilled maintenance to insure reliable and economical engine service; the necessity of investing for the peak-load rating of the establishment in buying an engine, which has little overload capacity in comparison with that of the motor; the absence of spare units in motor installations; and great difficulty of meeting additional power demands economically as the plant grows, when an engine installation has been in service for some time. It is to be hoped that power solicitors will make a more general effort to express these points in terms of money, where specific conditions permit, for they go far toward demonstrating that in the long run electricity is the cheapest motive power available to the small consumer of energy.

SHOULD THE SMALL CENTRAL STATION ENGAGE IN ELECTRICAL CONSTRUCTION?

To one not familiar with actual conditions it might appear that the really intricate problems of central-station policy were confined mainly to the management of the affairs of the large plant. On the contrary, however, the matter of directing the interests of a small lighting and power plant, serving a single town of, say, ten thousand inhabitants or fewer, in such a way as to insure a reasonable profit on the money spent in equipment and operation, very often involves problems equally as difficult of solution as those usually encountered by the management of the largest plants. Of these problems, the question as to whether the small central station should engage in electrical contracting is one in which there exists what would seem to be a rather unfortunate division of opinion.

Without further discussion, it may be stated that when the small central station does interior electric wiring it is very rarely done with any view to making a profit directly on the work. It is nearly always the case, in fact, that where the business of plants of the kind in question includes electrical construction, one or the other of two conditions, real or fancied, will be pointed out in explanation of that fact: either the local contractor is not considered sufficiently energetic in pushing the wiring business and thus promoting the sale of current or else it is thought that the central station can do wiring more cheaply than the contractor and in this way insure a larger sale of current than would otherwise be possible. It must be admitted, unfortunately, that the first of these two conditions does sometimes exist. The contractor in the small town, who, it may be, has but lately come from the ranks of the wage-earning wireman and is therefore deficient in business training, is by no means always so energetic and resourceful in pushing his business as his own interests and those of the local power plant demand. Where this is the case, however, it is usually better for the central station to undertake such co-operation with the contractor as will result in his education along the necessary lines rather than to become

his competitor. There are few enterprises to the success of which the confidence and good will of the people served is more essential than in the case of the central station and that of the electrical contractor in the small town, and competition between these two interests here is quite liable to arouse ill feeling which will ultimately handicap the business of both.

As to the ability of the small central station to do wiring more cheaply than the contractor could do the same work, it may be remarked that it is seldom true that this is possible. The manager of such a plant, being usually its superintendent too, generally has but little opportunity to give house-wiring his own personal attention, and his wiring business is rarely sufficiently large to warrant his keeping continuously on the pay-roll wiremen of any considerble amount of skill or experience. In fact, about the only thing that can be done towards keeping the cost of wiring low is to encourage the use of the less stable types of electrical construction, and this in itself should be a strong argument against the company's engaging in the construction business at all. It unquestionably very often tends to perpetuate wiring practice of a character which might profitably have been discarded long ago when electric service passed the stage of experiment and established itself as an indispensable necessity in the modern building.

It appears, then, that after all, there is little real reason why central stations in the smaller towns should engage in electrical construction. That the logical and legitimate business of the central station everywhere is the generation and sale of electric power is, from present indications, a fact which is rapidly gaining general recognition. In the small town there are unusual opportunities for a hearty and intimate co-operation between all electrical interests; and, as already intimated, it is therefore comparatively easy, as a rule, for the central station to realize all the benefits of a continuously vigorous prosecution of the wiring business without having to do wiring itself.

HIGH-FREQUENCY TELEPHONY ON COMMERCIAL CIRCUITS.

Over a year ago, on January 14, 1911, announcement was made in these columns of a new system of multiplex telephony and telegraphy invented by Major George O. Squier, of the United States Signal Corps. Since that time some skepticism has been expressed as to the feasibility of the application of this method on commercial lines. A test of the method was made this week upon a commercial line between Washington and New York, as reported upon page 310 of this issue. While the method appears to have been successful insofar as the transmission of a message goes, there was apparently no effort made to carry out the multiplex feature in these tests. The high-frequency currents were, however, superposed upon the line without interfering with its ordinary use, and thus two conversations could be maintained without interference.

The energy required for transmitting [illegible] signals by this method is much less than that required [illegible] wireless, using the same frequency, and it presents the additional advantage of freedom from interference by other sending stations.

ECONOMICAL OPERATION OF POWER PLANTS.

The paper which was presented by Mr. George I. Rhodes at the meeting of the American Institute of Electrical Engineers last week formulates some important conclusions which can be applied by every designer and operator of a power plant, whether that plant be a central station or one supplying power for an individual concern. Mr. Rhodes investigated particularly the relation between the general cost of power and the operating conditions under overload. While the elements of cost which go to determine the result under varying conditions of load-factor will necessarily be different in different plants, the general trend of the curves which he plotted are not affected thereby.

Perhaps the most important thing brought out by this paper was that, regardless of the diminished efficiency of operation under heavy overloads, the average cost of generation will be less when the machinery is crowded to its utmost capacity under peak load. The advantages of such operation come in in two ways. The no-load losses are less with a smaller capacity of plant, and secondly, the fixed charges are also less the smaller the capacity of the plant. These considerations entirely outweigh in effect inefficient operation under overload conditions. The point of maximum efficiency in operation is usually at or near full load. The efficiency falls off only gradually with overload and in the worst case is not very low even at the highest possible overload. Steam turbines are usually rated in such terms that but a slight overload is possible. Electric generators have usually a wide margin of overload capacity, but in utilizing it care must be observed that the overload is not maintained for too long a period or injury to the machinery will result. Consequently, although the rating of boilers and of reciprocating steam engines is such that a large continued overload would be possible, the margin of operation in actual modern plants is not very large. The statement referring to steam turbines is also largely true of gas and oil engines. The principle may be regarded as established, however, that in laying out a plant it should be contemplated to utilize the equipment to the highest possible permissible loading at the time of peak load, rather than to allow a large margin.

This general conclusion, brought out so forcibly by Mr. Rhodes, is one which should be kept in mind by engineers who are desirous of securing operation which will show the highest economy in the yearly output.

Arrangements for Northwestern Electric Show.

At a special meeting of the Board of Directors of the Northwestern Electric Show Association, held last week, the members took up in detail the reports of Manager R. W. Clark on the headway made in preparation for the big 1912 Electrical Exposition of March 16-23 at the Minneapolis National Guard Armory.

The board was enthusiastic over the prospects. Nearly 100 high-class exhibits by representative concerns from all parts of the country, embracing many hundreds of electrical applications to commercial and domestic life, have been secured.

President Fred G. Dustin, chief city electrical inspector of Minneapolis, presided at the meeting and many matters of importance were disposed of, including final approval of the elaborate electrical and decorative plans for the exposition upon which Manager Clark and the architects have been at work for many months past.

Arrangements with M. M. Wood for his great exhibition of the "Wireless Light and Gyroscope" act together with his act of "Flying Without Wings" were ratified, while arrangements were made whereby Miss Blanche Mehaffey will again sing with the First Regiment Band of the Minneapolis National Guard, which has been engaged for daily concerts during the Exposition.

Consideration at this meeting was also given the matter of the 1913 Electrical Exposition and it was definitely decided in view of the assured success of the coming third annual event, to begin work immediately on the fourth exposition tentatively planned to be held in March, 1913.

Banquet of Pittsburgh Section.

The annual banquet of the Pittsburgh Section of the American Institute of Electrical Engineers is being held today, February 17, at the Fort Pitt Hotel.

Loyal A. Osborne, vice-president of the Westinghouse Electric & Manufacturing Company, is to act as toastmaster, and President Gano Dunn of the Institute is the guest of honor and will make an address. The other speakers are A. A. Hammerschlag, of the Carnegie Technical Schools; H. E. Longwell, of the Westinghouse Machine Company, and A. Leo Weil, president of the Voters' League of Pittsburgh.

The banquet will be largely attended by members of the Institute and their friends. The speeches are to be of a general and popular nature rather than technical.

Review of Electric Club Matters.

Reports presented by the retiring officers of the Electric Club of Chicago show the Club to have a cash balance of $3,756.39, an increase of $495.91 over last year. A net gain in membership of six was made although 54 new members were secured during the year. The average attendance at meetings was 57 as compared with 50 for last year.

American Institute Trip to the Panama Canal.

The trip arranged by the American Institute of Electrical Engineers to inspect the Panama Canal was terminated on February 8, when the New York contingent arrived at home. The official representative of the Institute upon this trip was George F. Sever, and at the meeting of the Institute on February 9 he was called upon for a report.

There were 110 persons on the trip, 43 of whom are members or associates of the Institute. One party left New York, and a second party left New Orleans by steamer. The two parties united upon arriving at the Isthmus of Panama. A special train conveyed the party to the Hotel Tivoli at Ancon, just outside of the city of Panama. Trips of inspection were made each day of the week spent at the Isthmus, special trains being put at the disposal of the party by Colonel Goethals. Visits were made to the Culebra Cut, the Gatun locks and dam, to the sanitarium on Taboga Island, to the Pedro Miguel and the Mira Flores locks and to the wrecking dredges at Colon. On Saturday evening there was a dance and reception given by the Tivoli Club, at the Tivoli Hotel, and on Monday evening the Institute party gave a reception and ball to the club members. This was attended by the President of the Republic of Panama, Dr. Pablo, who also tendered a reception to the party at his palace.

Des Moines Electric Company to Hold Show.

In connection with the annual convention of the Iowa Electrical Association and the Iowa Street Railway Association, which will be held in Des Moines, April 24 to 26, the Des Moines Electric Company will hold its first electric show, in charge of C. A. Willoughby.

The Business Men's Association of Des Moines has donated the Coliseum for this purpose and the Des Moines Electric Company will attend to the wiring and will furnish current free of charge. The only expense to exhibitors at this show will be in connection with the decorations.

Owing to the central location of Des Moines and to the holding of the electric show it is expected that this year's meeting will be the largest ever held by either of the state associations.

The New Edison Company Building in New York.

The new Forty-Second Street home of the New York Edison Company, which is under contract to be finished by May 1, will undoubtedly be one of the most perfect offices used by any central station in the world. Plans are now taking definite form as to how the various floors of this nine-story structure will be utilized.

The main floor will be made in every detail a most attractive electrical showroom. Toward the rear of this floor at the head of a double winding stairway will be placed an electric fountain. This will be a creation built of natural stones with glass of many different colors set between. Electric lights inside the fountain will produce an irridescent effect on the stained glass and over the whole pile will trickle the water. Back of the fountain and above it will be placed a bust of Thomas A. Edison. Directly above the fountain will be a dome skylight, which will be illuminated in an artistic manner at night by concealed electric lights. A soft indirect light will be shed over this whole floor, every bulb being concealed.

The second floor will also be a showroom for electrical devices and will be indirectly lighted. A plan has been drawn up by C. E. Law, manager of the Bureau of Illuminating Engineering, for a model apartment which will occupy the entire third floor. This apartment will be fitted up with attention to the minutest detail. Every electrical convenience for the household will be on demonstration here, so that a prospective customer can make his selection in the proper setting. The next five floors will be devoted to the offices of the contract and inspection department. The top floor is to be fitted up in a studio effect and will be occupied by the publication, advertising and photographic bureaus.

The illuminating plans are also exceedingly interesting. Generally speaking, every known system and method of electric illumination are to be employed. This includes not only the many various types of bulbs but varieties of fixtures as well. In this way it will be possible to show the many different methods of lighting in actual operation.

The building is to be faced with terra cotta and copper, the architecture being French Renaissance as applied to modern construction.

A contract has recently been made with Payne Brothers, the contractors, for 40-horsepower, in motors, to be used in the erection of the steel structural work on the new building. The entire cost of the building will be approximately $200,000.

Guy E. Tripp.

The Westinghouse Electric & Manufacturing Company is one of the largest industrial organizations in the United States, turning out over $40,000,000 worth of machinery and equipment annually. In 1907, it passed through a crisis in the midst of the financial panic, and because of its great resources and remarkably good standing in the financial community its reorganization and rehabilitation was made complete. The company is now on a thoroughly solid basis and its business is growing at a rate which apparently leaves nothing to be desired. Hardly, however, had the new officers been installed and the executive department settled down to grappling with affairs at issue, than the death of Robert Mather, chairman of the board of directors, was announced. This occurred in October of last year. At a meeting of the board of directors held in New York City a few weeks since, Guy E. Tripp, of Boston, Mass., was elected chairman in the place of Mr. Mather.

Mr. Tripp is a man of over twenty years' experience in various departments of railroad and electrical undertakings. He is regarded as one of the foremost experts in this country in his line. He is a native of Maine, about forty-seven years of age, and entered the employ of the Eastern Railroad before its consolidation with the Boston & Maine. Later he was engaged by the Thomson-Houston Electric Company in the work of changing the West End Railway of Boston from a horse-car line to an electric system. He became traveling auditor of the General Electric Company when that corporation was formed by the merger of the Thomson-Houston and the Edison General Electric Companies in 1892.

After serving as supervisor of the accounting and financial departments of the Industrial Improvement Company, Mr. Tripp joined the Stone & Webster organization in 1897, and has managed the western investments of that company in Texas and on the Pacific Coast. He has served as an officer in various public service corporations in Minnesota, Texas, and Washington.

One of his biggest undertakings, and one which is now engaging and will probably continue to engage a part of his time, is in connection with the reorganization of the Metropolitan Street Railway Company in New York. He went to New York from Boston in 1908, representing Stone & Webster in the rehabilitation of the Metropolitan Street Railway Company, and was made chairman of the joint committee on reorganization. The plan under which this reorganization has been effected was drawn under his supervision, and he is responsible for many of the clauses inserted in the plan whereby the bonds of the traction lines have already been placed on a recognized footing.

By temperament and experience he is eminently fitted for his new field of endeavor, and with the fine reputation that his company's material enjoys and the splendid facilities and manufacturing organization to work with he will achieve still greater success.

Guy E. Tripp,
Chairman of Westinghouse Board of Directors.

Smoke Abatement Exhibition in London.

An International Coal Smoke Abatement Exhibition is to be held in the Royal Agricultural Hall, Islington, London, England, March 23 to April 4, 1912, inclusive, under the auspices of the Coal Smoke Abatement Society. At this exhibition it is planned to show all the recognized means of diminishing or abolishing factory and domestic smoke. Similar exhibitions have been held at Sheffield and Glasgow.

Industrial Lighting Discussed Before Nela Engineering Society.

On Thursday evening, February 8, Ward Harrison, industrial lighting engineer of the National Electric Lamp Association, addressed the Nela Engineering Society of Cleveland on the subject of "Industrial Lighting."

Mr. Harrison emphasized the value of effective illumination in the industries, pointing out that the cost of illumination is invariably small compared with the increased value of output. Extracts from a number of reports on illumination tests, showing the relative cost and efficiency of different lighting units, were given. Among these the comparative tests recently conducted by the speaker in investigating the performance of mercury-vapor tubes, gas inclosed arcs and Mazda clusters demonstrated that 250-watt Mazda lamps equipped with a certain style of metal reflectors showed the same annual operating cost as that required for a 3.25-ampere, 220-volt, direct-current inclosed-arc installation, while five times as much light was received from the Mazda system. Another test on mercury-vapor tubes, gas and Mazda clusters showed in the particular case investigated that the intensity of illumination on the factory floor was decidedly more uniform with the Mazda units installed than with either of the other two illuminants.

Mr. Harrison went on to discuss the relative merits and proper fields of application of glass and enameled-steel reflectors, of deep, bowl, or parabolic types and the wider-angle reflectors, giving values of lumens absorbed, lumens in the 60-degree zone and lumens emitted above the 60-degree zone for the various types. Figures show that in some mills and shops a considerable increase in illumination may be expected from glass reflectors. Other considerations invaluable in choosing between glass and steel reflectors were discussed.

Several slides were used, showing some examples of particularly good illumination in factories. The appearance of these shops under artificial light compared with that of the same shops in the daytime brought out the fact that the artificial lighting actually produced better illumination results than daylight.

Latest Tests in "Wired-Wireless."

George O. Squier, major and assistant to the chief signal officer of the United States Army, who invented the multiplex telephone and telegraph system which he calls "wired-wireless," has been making a number of further experiments to determine various important data in regard to his invention.

Through the courtesy of M. M. Davis, chief engineer of the Postal Telegraph Cable Company, tests were made by Major Squier on Sunday, February 11, on a line extending from the Signal Corps laboratory at the Bureau of Standards in Washington, D. C., to 253 Broadway, New York City, the general office of the Postal Company. These tests followed previous tests made Sunday, January 21, on a line extending from the Signal Corps laboratory to Baltimore, which were of a preliminary nature.

The line used from Washington to New York on February 11 was both metallic circuit and grounded circuit, it being a mixed commercial line consisting of No. 9 B. & S. copper wires on poles, subterranean cable line in Baltimore, and subterranean and submarine cable lines through Philadelphia and entering New York City. The total resistance of metallic circuit was about 3,200 ohms. No change was made in this circuit as used in regular commercial telegraph service. The line went through the regular switchboards in the usual manner and something like thirty lightning arresters shunted to earth at the various terminal cable boxes and other points along the line. These lightning arresters were of the type provided with a thin sheet of mica and acted as small condenser leakage paths to earth.

The principal object of Major Squier's latest experiments on February 11 was to determine data as to the range of frequencies to be employed in reaching the longer distances by the "wired-wireless" system and also the order of magnitude of the energy necessary and sufficient for such purposes. The measurements taken at the transmitting end of this line extended over a range of from 34,000 cycles down to about 22,000 cycles per second, and as the special generator employed had a range from about 20,000 to 100,000, no experiments were made below 22,000 cycles.

The importance of tuning such a line to resonance and the comparative ease with which this can be done with the commercial wireless apparatus were clearly demonstrated. This tuning of the line, whether a metallic circuit or a grounded circuit, required only a few minutes. As a specific instance of the order of magnitude of the quantities used in these experiments, the following data are given:

Resistance of metallic circuit	3,200 ohms.
Frequency	22,000 cycles.
Transmitting line voltage at resonance	65 volts.
Transmitting line current at resonance	250 milliamperes.
Transmitting impedance at resonance	260 ohms.
Maximum power	16 watts.

Among the experiments conducted on February 11 was one to determine the most suitable form of coupling between the generator circuit and the line circuit, the generator being directly connected to the line through the tuning elements as well as in the more usual manner of inductive connection. It was found that inductive coupling to the local generator circuit is far more efficient and convenient and further enables a number of lines to be operated from one generator with great ease.

At the receiving end, the ordinary wireless-telegraph receiving equipment was employed, using the Audion detector, with high-resistance telephone receivers, and the elements were tuned to the particular frequency being transmitted. It was found desirable to tune the line both at the transmitting and at the receiving ends and to adjust the coupling to the optimum value in both cases.

The prime importance of operating these circuits at resonance was strikingly manifested since, when the generator terminals were directly connected to the line without the tuning elements only the smallest readable current was obtained, whereas with proper tuning, this current could be multiplied some hundreds of times. With a transmitting current of 260 milliamperes at 22,000 cycles signals just audible were heard in New York, thus indicating the lower limit of transmitting power with the particular line and frequency in use.

In the previous experiment with a line to Baltimore about 48 miles long, frequencies up to 44,000 were used with a transmitting current of only 180 milliamperes, giving very loud and clear signals far better than would be necessary in traffic.

A large number of physical measurements were made on February 11 at the transmitting end of the line (which was Washington) over a comparatively wide range of frequencies, and the results obtained confirm what was expected from previous work on other lines. It appears evident to War Department experts that the range of frequencies for "wired-wireless" will extend from about 10,000 per second as a lower limit, up to about 100,000, which is considerably above the lowest frequency now employed in long-distance wireless communication.

Just as in wireless work the longer wave-lengths are used for the greater distances, so in "wired-wireless" the longer wave-lengths, corresponding to the lower frequencies, will be employed for the long-distance circuits, reserving the shorter wave-lengths and lower power for the shorter circuits.

It is clear from the above figures that the great increase in efficiency obtained by directing electric waves along wires to their destination, as shown by the amount of power required to send audible signals over such a circuit as described, is beyond question. The power necessary to transmit messages from Washington to New York by wireless communication would be about five kilowatts.

Convention of the Supply Jobbers' Association.

The Electrical Supply Jobbers' Cleveland meeting will go down in history as the most successful meeting, from the point of attendance and interest, of the Electrical Supply Jobbers' Association. It was held in Cleveland, O., February 13, 14 and 15. About 150 jobbers and several hundred manufacturers were in attendance. Headquarters were established at the Hollenden Hotel. On Tuesday morning meetings were held by the Atlantic and Central Divisions and general meetings were held in the afternoon and evening. A special meeting was held on Wednesday morning and in the afternoon a trip was made to the works of the National Carbon Company. The concluding meeting was held on Thursday and the afternoon was devoted to a visit to the Engineering Department and factories of the National Electric Lamp Association. On Tuesday evening a big rejuvenation of the Sons of Jove was held at Elks Hall, under the direction of Statesmen J. E. Erickson and P. S. Dodd. The initiation was preceded by a torch-light parade. A class of 62 was received into the order. The rejuvenation was followed by a buffet supper. On Wednesday evening, the jobbers and all visiting electrical men were entertained at a valentine party and smoker by the Electrical League of Cleveland.

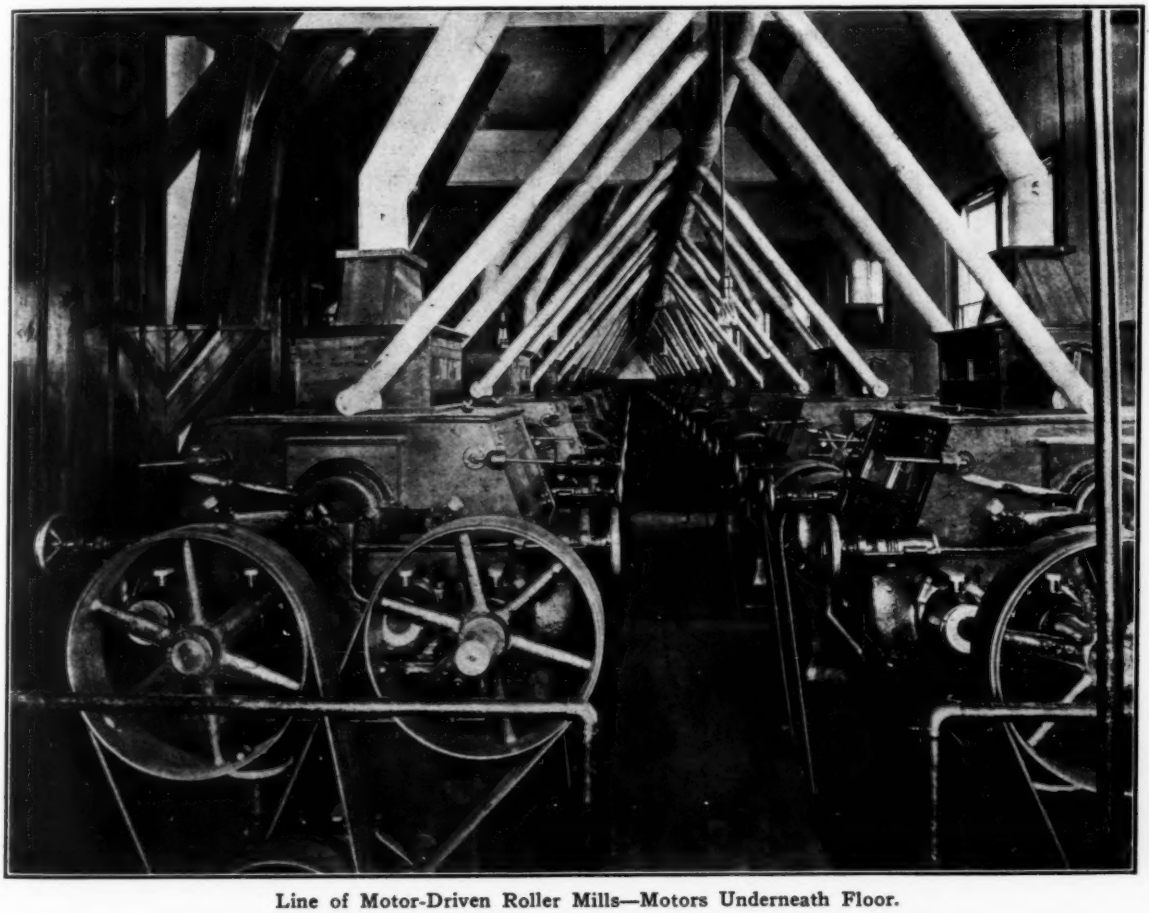
On to Denver.

The Chicago Association of Electrical Contractors has appointed a committee to work up the largest possible attendance from Chicago and the state of Illinois at the Denver convention of the National Electrical Contractors' Association, which will be held in July. It is proposed to get up a party sufficiently large to warrant the running of a special train from Chicago. B. L. Akins, 4551 Evanston Avenue, Chicago, and Ernest Freeman, 538 South Dearborn Street, Chicago, are the members of the committee.

Electric Power in Flour and Grist Mills.

The keenest competition among millers has rendered necessary a close study of the various factors which enter into the total cost of producing a barrel of flour. The use of central-station power has enabled many millers to lower the cost of their product. This article gives results of many tests on flour mills, showing what results may be expected under the various conditions found in different plants.

Actual statistics collected by the United States census bureau show that the production of flour in this country is slightly greater than one barrel per capita per year. Of this amount less than 10 per cent is milled in the great establishments of Minneapolis and Duluth, the remaining 90 per cent being distributed among the 18,000 mills scattered over the country. While it is generally considered that the majority of mills are situated in towns too small to boast of a central station, fully 40 per cent of the milling capacity of the country is accessible to central-station power. Considering now only those mills that are accessible to power from a conveniently located central station, about 56 per cent use steam power. The remaining mills use gasoline and water and a combination of these, while about two per cent use electric power exclusively.



Line of Motor-Driven Roller Mills—Motors Underneath Floor.

The advantages of electric drive in flour mills are certainly most pronounced. First in point of importance is the marked reduction in fire risk, especially where central-station power is used. The frequency with which fires occur in flour mills is a source of much concern among mill owners and any method of reducing the enormous loss sustained each year will meet with hearty approval. If power is obtained from an adjacent steam plant the fire risk is great and insurance rates correspondingly high. Mechanical drive necessitates either the dangerous proximity of the boiler room or heavy losses in long steam mains or rope transmission. If central-station power is used all danger from adjoining power plant is removed; in any case electric drive does away with the inflammable dust inevitably carried into the engine room by the large belt. The elimination of heavy line shafts also greatly reduces the danger of fire from overheated journal boxes and also from spontaneous combustion.

The Millers' National Insurance Company not long ago investigated fires in 482 mills, of which one-half were totally destroyed, during the ten-year period from 1897 to 1907. The records show that the kind of power used was distributed as follows:

		Per Cent.
1	Water and gas	.21
1	Steam and electric	.21
2	Steam and gas	.41
3	Gas	.62
4	Electric	.82
30	Water and steam	6.22
79	Water	16.39
362	Steam	75.12
482	Mills.	100.00

The evidence as to the causes of these fires is not conclusive because in 210 cases, or 43.57 per cent of the whole, they are stated to be unknown.

It is reasonable, however, to suspect some connection with the steam plant, since, in three-quarters of the fires, the mills were driven by steam power. Flour and wheat dust aid in clogging the shafting and in heating the bearings. Except for this trouble the dust is comparatively harmless when it is in a settled state. But when mixed with air in the proper proportion it becomes highly explosive. Every effort is therefore made to collect and dispose of the dust from the cleaning and milling machinery. It is good practice to endeavor to avoid trouble by reducing contributory causes. The careful miller welcomes the substitution of direct individual motor drive for the interminable shafts and belts necessary with steam drive. The most striking results are greater economy in production and less danger of fire and, consequently, lower insurance rates.

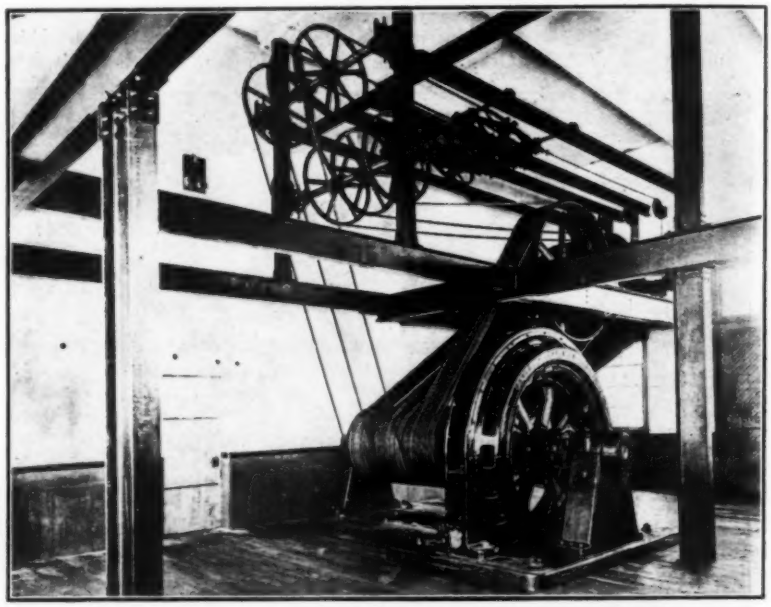
Other advantages of central-station service, such as reliability, availability at any moment day or night, decreased investment in plant, freedom from annoyance and expense which must accompany the operation of an isolated plant, freedom from hazard of boiler explosions, etc., are of even greater importance in flour mills than in the majority of industries. Also, electric drive minimizes the danger of accidents and delays and by means of suitably located remote-control switches make it possible to shut down the entire mill instantly in case of emergency. It may be stated that during the month of December (1911) six men were killed in mills by being caught in the belts and machinery.

In order that the power solicitor may have a clearer understanding of the conditions to be found in flour mills, a brief description of the present methods of milling may be in order. Rolls are, as implied by the term, solid cylinders of iron or steel which are now used to grind, crush or reduce the wheat and its various parts to flour and offal, instead of the mill stone which hitherto had been used from time immemorial in one form or another. Rolls work in sets or pairs, i. e., two rolls constitute a pair and work together. Of necessity these rolls must run or turn towards each other, and are set level and parallel to each other at various distances apart, according to the fineness desired, or the nature of the stock or material to be reduced. The rolls breaking down the wheat in succession are called "break rolls" and are fluted or corrugated; while the rolls for crushing the various grades and middlings are usually made with smooth surfaces and are called reducing rolls. It is customary in speaking of a mill using, say, five sets or rolls for breaking down the wheat, and seven sets, or pairs of smooth rolls for the middlings, to call it a five-break and seven-reduction mill.

These rolls have certain differentials, i. e., one roll of a pair runs faster than another, according to the kind or nature of the material to be reduced. Corrugations are coarser on the first-break rolls that first receive the wheat, each successive pair of break rolls having a little finer corrugation than the preceding pair. After each break or crushing, the stock is elevated or taken to some sifting or bolting machine, where the fine parts, such as the flour and middlings, are separated by the process of sifting or bolting. These parts go through the meshes of the wire or silk cloths, while the coarser, or brany, parts go over the end to the next break roll for further breaking down. The flour and middlings thus made in gradually breaking down the wheat, are again sifted, and the separation divided into flour and various sizes, or grades, of semolinas or middlings. The flour is drawn off as a finished product, the middlings are graded and purified and are then reduced on smooth rolls. The process of reducing them is almost identical with that of breaking down the wheat.

After each reduction, the stock is sent to a reel or a section of the sieve machine, the finest being flour, and is drawn off as the finished product, going directly to the packer or flour shed. At certain stages along the line of the middlings, reductions and separations, there are portions of stock which are taken over the end or tail of the reel or sieve, having been denuded entirely, or nearly so, of the floury parts, and thus being no longer fit for further reduction or bolting. These consist almost wholly of fine portions of bran, germ and cerealine, forming the outer cover of the berry and some cellular tissue from the interior. This is sent direct as a finished product to the "shorts" or feed bin, while any stock that still contains some flour-making material is again reduced and bolted, throwing off to feed another portion, etc., until all of the flour it possible to obtain has been extracted. The result is so much flour, bran and "shorts."

In some of the larger and better equipped mills, there are from 7 to 10, or even more, distinct operations in cleaning and preparing the wheat, before the first grinding operation takes place. Add to this the operations of grinding and separations in the way of scalping, grading, dusting, dressing and purifying; and one realizes that it has been necessary for several parts of the wheat to travel through or over many machines, and to have gone through fifty distinct operations at least, before the wheat has been converted to flour and feed. From this it will be seen that from the most simple and crude form as a beginning, milling has grown and advanced and has become an elaborate and complicated industry.



One of the Motors Driving Section of Maple Leaf Mill.

Selection of Motors.

As is usually true, the selection of the proper motors for mill drive is very important and should be given due consideration. Where alternating-current supply is available, the polyphase induction motor with slip rings and external resistance for starting should be specified. The type of alternating-current

polyphase motors with polar-wound rotor and internal starting resistance, while possessing admirable torque and starting-current characteristics, is not generally recommended for mills since dust almost invariably may be expected to collect on the starting resistance. Induction motors should preferably be wound for moderate rather than slow speed, since, in addition to the decreased size and cost, the power-factor and efficiency of the moderate-speed motor is better than that of the slow-speed type. Also three-phase motors have better power-factor than two-phase.

If only direct-current supply is available, motors should be compound wound. Direct-current motors should be totally inclosed, except in those cases where they are located in a separately partitioned room, in such a manner as to eliminate fire risk. Large motors should be artificially ventilated and supplied with piping to and from outlet openings.

Universal Bolters Driven by Motors Mounted Beneath Floor.

Iron conduit is best adapted for wiring in flour and grist mills. Fuses and switches should be inclosed in dust-tight cabinets. Rheostats should also be inclosed. There are dust-proof types on the market for this service which are better than ordinary types inclosed in cabinets.

Cost Data and Power Requirements.

The following data will probably be of assistance in demonstrating to the prospect the lower cost of power per barrel output where purchased power is used.

Mill No. 1—Normal capacity of mill as run, 45 barrels of wheat flour, and 130 bushels of corn meal in a day of 11 hours. The mill is driven by a 60-horsepower direct-current motor. All apparatus is run simultaneously the entire day, except the corn-crushing mill. One of these mills is operated usually about 10 hours per day. The second mill is only used from time to time when more than normal ouput of 132 bushels of corn meal has to be ground. The mill runs about 11 hours daily, and in that time makes 45 barrels of wheat flour, and grinds an average of 120 to 132 bushels of corn meal. From tests made it was found that the entire mill, including both pairs of corn stones, required 53 horsepower. Without the corn stones the machinery for the manufacture of wheat flour alone required approximately 38 horsepower. Average consumption of current for an 11 hour day, 320 kilowatts. It was estimated that one fourth of the daily power consumption was required for operating the corn stone, and the balance for manufacturing the 45 barrels of wheat flour. This shows that about 5.3 kilowatt-hours were required for a barrel of flour, and about 0.6 kilowatt-hours to crush a bushel of corn. At the rate current was bought, the cost per barrel of flour for power was 7.8 cents, and for crushing a bushel of corn, 0.81 cents. As a comparison between the operating cost of steam and electricity, to drive a mill of the above capacity, it may be of interest here to record that previous to the adoption of electric power, this mill had a daily expense as shown in Table I.

As the mill then had only a capacity of 25 barrels of flour daily, the resulting cost was 24.2 cents per barrel of flour, or 16.4 cents more than the cost with electric power, or a saving of 200 per cent per barrel of flour made.

TABLE I.

Fuel	$3.75
Fireman	1.50
Oil, waste, etc.	.25
Additional insurance rate on steam driven plant equivalent to daily charge	.15
Interest and depreciation on steam plants (10 per cent. per annum on $1,500.00)	.41
Total	$6.06

Mill No. 2—This is a small mill, having a capacity of 22 barrels of wheat flour and 440 bushels of corn meal.

Mill is driven by a 50-horsepower 230-volt, direct-current moderate speed, belted motor. The average consumption taken over a period of four months was 170 kilowatts. The average bill was $65.70 per month, or $15.70 per connected horsepower per year. Percentage of average to connected load, 37 per cent. For the sake of an approximate estimate, it may be calculated that 0.2 kilowatt-hours, per bushel, of the power bill may be chargeable to corn grinding and five kilowatt-hours per bushel, to wheat milling apparatus. On this basis the cost of current to prepare the flour would be 6.8 cents per barrel, and that for corn grinding, 0.22 cents per bushel.

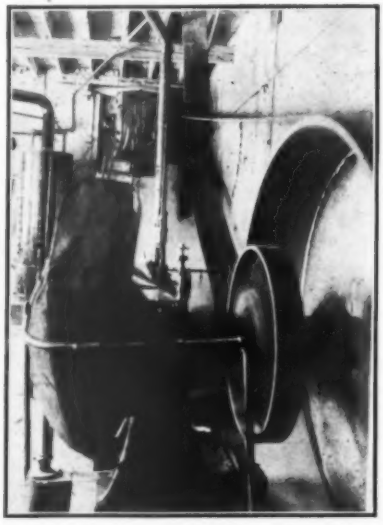
In connection with the amount of power consumed to drive a flour mill of given capacity, it might be said that this is regulated to a large degree by the operator. Operators who work their bolts only sufficiently tight to drive the machinery perfectly and who will watch closely the setting of their rolls, will naturally use a considerably less amount of power than those who are inclined to be careless about these matters; so that at best we can only give an approximation of the amount of power required for mills of different capacities. While it is true that power to drive flour mills can ordinarily be given as so much horsepower per barrel capacity, it has been found that smaller plants require a little more power per barrel capacity than larger ones. The following schedule has been worked out for wheat mills up to a capacity of 1,000 barrels, above which it is usually figured that one horsepower is required to each 3.5 barrels capacity per 24 hours for soft wheat, and one horsepower to each three barrels capacity per 24 hours for hard wheat. For cereal plants—i.e., corn mills where degerminators and dryers are used, and the plant is erected for manufacturing hominy, grits, brewers' meal and corn flour—in plants having a capacity up to 100 bushels per hour, it is safe to figure two horsepower to each bushel capacity per hour; that is to say, plants capable of milling 100 bushels per hour should be supplied

with 200 horsepower capacity at the prime mover. Cereal plants of greater capacity than 100 bushels per hour can be safely rated at 1.75 horsepower to each bushel capacity per hour.

RATING OF FLOUR MILLS.

Capacity for 24 hours, barrels.	Soft Wheat. Horsepower.	Hard Wheat. Horsepower.
30	15	
40	18	
50	22	
60	26	
75	32	
100	40	44
125	45	52
150	54	60
175	60	60
200	66	80
250	77	95
300	87	108
400	115	134
500	143	165
600	170	200
750	214	250
1000	286	335

Addition data on the power required to drive are given in the following table. There are many conditions that enter into the problem of the proper



Motor Belted to Engine Flywheel—Michigan Milling Company.

size of motors however and these must necessarily be considered for each individual case.

Six-Roller Mills. Size.	Capacity.	H. P. Required.
7 x 14	30- 45 Bushels	6- 9
7 x 18	40- 60 Bushels	8-12
9 x 18	50- 75 Bushels	9-15
9 x 24	65-100 Bushels	12-20
Single Pair Mill.		
9 x 30	250-300 Bbls.	3 -4
9 x 24	200-250 Bbls.	2 -3
9 x 18	125-150 Bbls.	1.5-2.5
9 x 15	100-125 Bbls.	1.5-2
9-in. Double Roll Mills.		
9 x 30	500-600 Bbls.	4-6
9 x 24	400-500 Bbls.	3-5
9 x 18	250-300 Bbls.	2-4
9 x 15	200-250 Bbls.	2-3
6-in. Double Roll Mill.		
6 x 20	200-300 Bbls.	1.5-2.5
6 x 15	150-200 Bbls.	1 -2
6 x 12	120-150 Bbls.	1 -1.5
Peerless Shifter		3
Smith Purifier		4
Reels & Flour Dresser		1

In grist mills the installation of central-station service eliminates the services of a man, which is a big factor in mills located in small towns. Also, small mills, having a limited labor market, must frequently employ engineers who are either ignorant or careless and the damage these men can do is well known. Another factor that points to electric drive as the logical drive for grist mills is that in many plants grinding is done only on receipt of orders. In such cases, where a steam engine is employed the plant must be kept in operation continuously although actual grinding time is only a few hours a day. In many grist mills this waste is being partially eliminated by specifying certain days for grinding but experience has shown that considerable business is lost by this procedure.

With electric drive, purchasing power from a central station, all labor troubles disappear and the cost of grinding is in direct proportion to the number of bags ground; there is no waste.

Theodore Blech, power agent Public Service Company of Northern Illinois, an authority on grist-mill drive, has had considerable experience in substituting central-station service for steam and gasoline engine drive. The greatest objection with the latter is the difficulty in starting, particularly in cold weather, the time required varying between 10 and 35 minutes. In many instances the gasoline engine is allowed to run continuously on account of starting troubles and in these cases the cost of extra fuel frequently has paid for electric current when a motor was substituted.

In the majority of small grist mills the changing over from steam or gasoline-engine drive to electric involves no expense beyond the purchase of a motor. The accompanying sketch may be considered typical of the conditions found in an engine-driven plant. In this case the shaft is held in four hangers. The mill is a 24-inch Monarch grinder and the line shaft was driven by a 70-horsepower Westinghouse automatic engine. A 40-horsepower 1,200-revolution-per-minute slip-ring motor was used to replace the engine, and has done its work efficiently and at a much greater economy. The consumption of this mill is 0.65 kilowatt-hours per bag of corn ground. A special difficulty was encountered in this case on account of the short distance between the line shaft and wall this distance being eight feet. In order to gain as much space as possible the motor was mounted on a scaffold six feet above the ground and the distance between the pulley centers made 14.5 feet.

Before considering typical flour and grist mill installations it may be well to call attention to the rapidly increasing use of electric ovens by millers. These are used both for testing and demonstrating, and have been proven economical and efficient. The standard types, made in all sizes, are well insulated and consume a minimum amount of current after the oven has been brought to baking heat. As an example, an oven with a baking space of 40 by 18 by 12 inches would consume 1,800 watts to heat to the baking point and 600 watts thereafter regardless of the number of "batches" baked.

Typical Installations.

The new plant of the Maple Leaf Flour Mills Company, located in Canada, although too large to be typical, having a capacity of 3,000 barrels per day, nevertheless emphasizes the advantages of electric drive in flour mills. The plant is situated in Western Ontario, 126 miles east of Winnipeg on the main line of the Canadian Pacific Railroad. Electrical energy for lighting, heating and power is supplied by the city plant at the City of Kenora.

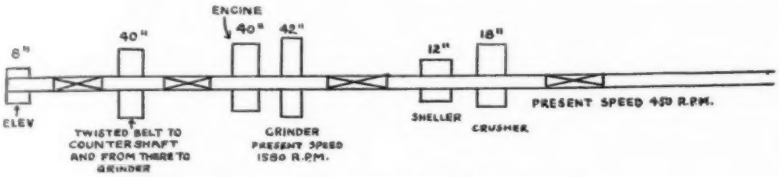
The mill comprises a grain-storage

Motor and Switches in Isolated Room —Michigan Milling Company.

plant of about 500,000 bushels capacity, a mill with a present capacity of 3,000 barrels of flour per 24 hours and with room in the same building to double the capacity and a large warehouse for storing and shipping the output from the mill. The elevator and mill are located in a line parallel with the main line of the railway, with a private side track on the railway side of the plant.

The grain-storage plant consists of 10 reinforced-concrete tanks 26 feet inside diameter by 80 feet high, and four center tanks, with a total capacity of about 380,000 bushels, and a head house or working house at the end opposite the mill with a storage capacity of 75,000 bushels. The head house is well equipped with receiving, weighing and grain-handling machinery of ample capacity, car pullers and power shovels. Grain is carried from the head house to the tanks by a belt conveyor

with a traveling tripper to discharge into any one of the tanks as required. Underneath the tanks is a similar conveyor carrying back to the head house and discharging into one of the large elevators. As is usual in such plants the conveyors and elevators are so arranged that grain can be turned into the bins whenever it may be necessary, and the mill is supplied with wheat as needed by a belt conveyor extending across from the head house into the cleaning department, which has an additional storage capacity of 30,000 bushels making a total storage capacity of 500,000 bushels of wheat.



Typical Layout of Shafting in Small Mill.

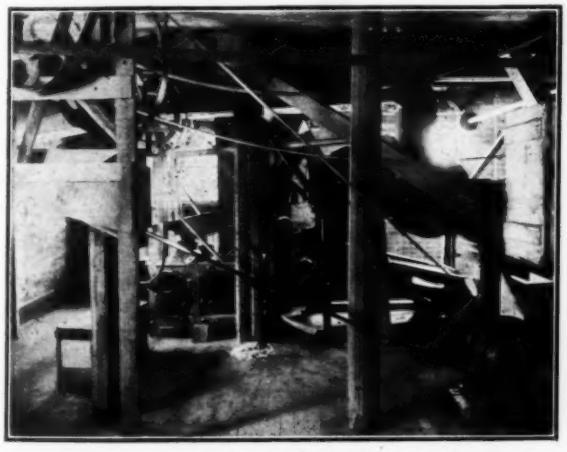
The wheat-cleaning department is located in the main building which adjoins the storage tanks on the west, and it is separated from the mill proper by a fire wall extending through above the roof. This department is unusually complete even for a mill of this size and is equipped and arranged with a view to putting wheat of any kind or grade into the best possible milling condition. The equipment of separators, scourers, and dust collectors is very elaborate and in addition there are a wheat washing and drying plant of large capacity and a most complete arrangement of apparatus for thoroughly tempering the wheat before grinding. The machinery is arranged to be used for either wet or dry cleaning or any desired combination of the two processes. All of the machinery in this department is driven by a 250-horsepower, 2,200-volt, 60-cycle three-phase induction motor located on the first floor and connected by belt to the main line shaft in this story. The machines on the lower floors are driven by belts directly from this shaft, the remainder of the power being transmitted by rope drive to a secondary line shaft in the fifth story, from which it is distributed to the various machines in the upper stories by belts. The cleaning department also contains a double 9 by 18 roller mill and two scalpers for reducing screenings to go into bran and feed. Access to the different stories of the cleaning department is provided by a Humphrey passenger elevator extending through from the first floor to the attic. This is driven independently by a five-horsepower induction motor, which makes the elevator available for use when the machinery is not in operation.

The first floor of the mill proper contains the main line shafts and the elevator boots, and this story is of sufficient height to leave ample head room under all pulleys. There are two lines of shafting extending nearly the full length of the building and a third extending about one-half its length, these shafts carrying the pulleys which drive the roller mills on the second floor. The shorter line is driven from one of the principal lines, and from the other power is taken by rope drive for the machinery on the upper floors.

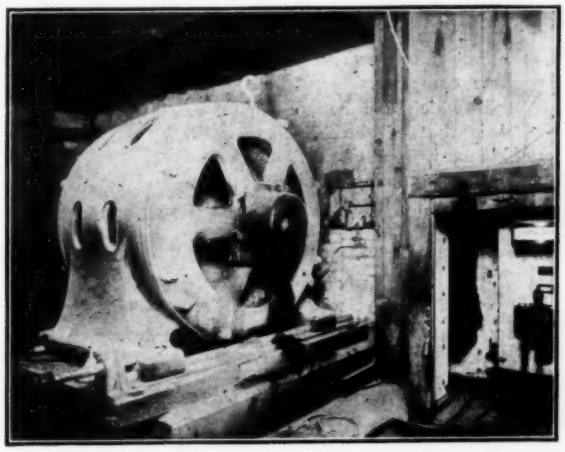
The second floor is the grinding floor and contains 30 double, 10-by-36 roller mills of the latest style, equipped with ball and socket collar oiling bearings, and the regular "A" drive. Nine of these machines are corrugated and the remainder smooth. They are placed in two full lines and one shorter line directly over the line shafts in the first story, with ample passage ways between them. The rolls are ventilated by means of the Allis patent roll suction, a pipe leading from each side of the feeder on every machine and leading into main suction trunks overhead and these to the suction fans on the floor above. By means of suitable valves the suction is under complete control.

The third floor is used mainly for spouting and contains nothing of special interest, the only machinery located here being the bran dusters, two flour dressers, two feed-grading reels and the roll suction fans. The fourth fifth and sixth floors contain the bolting, purifying and packing machinery, the arrangement of which has been carefully worked out. The most important part of the bolting system consists of 13 72-inch Vibromotor Universal bolters, set in one line on the sixth floor and occupying the entire length of this floor. Directly below the bolters, on the fifth and fourth floors, are the purifiers and reels, there being in all 22 Reliance purifiers, eight No. 4 Allis centrifugal reels and three No. 4 Allis flour dressers. For collecting dust from the purifying system the purifiers are paired and each pair discharges into one large Niagara dust collector suspended from the floor above and at sufficient height to leave full head room underneath them. Back draft is taken from all the purifier dust collectors by means of a complete system of Allis patent suction piping connected to a 30-inch fan, the latter discharging into a separate dust collector.

The finished flour of all grades, bran and feed are delivered into specially



Motor Driving Cleaning Machines—Michigan Milling Company.



Main Mill Motor with Starter—Michigan Milling Company.

designed wood bins of the round type starting on the fifth floor and extending up through this and the sixth story, each bin having a capacity of about 150 barrels of flour. The packers are located in a line on the fourth floor directly beneath the bins.

In the seventh story are found the elevator heads, all in one line, with a complete suction system with connections to every elevator. On this floor are also the dust collectors for roll and elevator suction and purifier back draft. For access to the several floors there is a Humphrey passenger elevator and a barrel and sack elevator, both centrally located and serving all the floors. Power is supplied by a 12-horsepower induction motor, the elevators thus being available for service at all times whether the mill is in operation or idle. There is also a freight elevator at one end, driven independently by a five-horsepower motor.

Power for the mill proper is furnished by a 650-horsepower, 2,200-volt, 60-cycle 3-phase induction motor, the shaft of which carries a 44-inch sheave grooved for 32.75-inch ropes. Part of the ropes transmits power to one of the main roller line shafts, and the remainder drives the other main line from which power is taken to drive the machinery in the upper stories of the mill. The entire mill is heated electrically.

Three of the accompanying illustrations are interior views of a mill similar to the one just described, owned by the same company.

A mill which can be considered as typical is that of the Michigan Milling Company, located at Ann Arbor, Mich. This company formerly operated three mills in Ann Arbor, two using steam power and one water. It was finally decided to equip the water-power mill with an electric generator of sufficient size to supply the two steam-power mills in addition to supplying its own requirements. This arrangement, while having advantages when water was available often necessitated the closing of the water-power mill and the operation of the other two by steam engines, thus greatly increasing the cost of power.

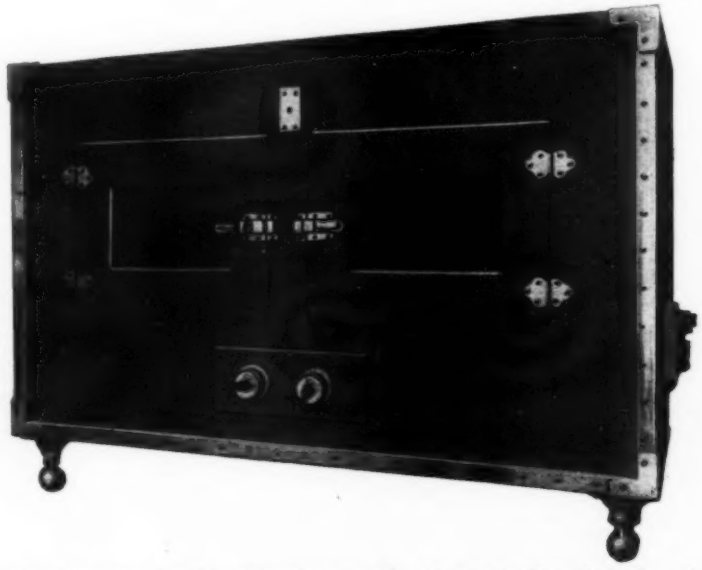
When the mill located on the water-power site was distroyed by fire the milling company at once arranged for power from the local central station, the advantages of electric power over steam being fully realized by the mill owners who had had experience with both, as well as with water-power. While no figures are available showing the relative costs of power in this mill, the owners state that a considerable saving is being effected when all elements entering into the cost are considered. One of the points emphasized by this company which is true in many localities is that it is very difficult to obtain experienced engineers in a small town especially where there is no guarantee of uninterrupted employment.

A three months' test was made on this plant and the current consumption per barrel found to be 10.5 kilowatt-hours. The total connected horsepower is 105 and the average monthly consumption 27,857 kilowatt-hours. The load-factor of the plant is 48 per cent. The mill has a capacity of 240 barrels per day of 24 hours.

A smaller mill having a capacity of 170 barrels per day but with the same electrical equipment is also owned by the Michigan Milling Company and supplied with energy by the Eastern Michigan Edison Company. In both cases the main mill motor, of 75-horsepower size is belted directly to the flywheel of the old steam engine. A view of this installation in mill No.2 is shown in one of the illustrations. There are also shown views of the other motors in the two mills and in the bean house run in conjunction with mill No. 1. In both mills the motors are located in isolated partitions removed from the dust. All motors are controlled by automatic starters inclosed in asbestos-lined wooden boxes. All wiring is run in iron pipe. The detailed motor installation will be found on the data sheets.

Relative to grist mills, the results of tests taken on three mills in the Chicago territory by the Public Service Company of Northern Illinois are of more than passing interest and serve to illustrate the conditions found in the average plant.

Mill "A" was previously driven by a 45-horsepower gasoline engine but it was found impossible to secure the proper speed from this arrangement. A 75-horsepower motor was substituted for the gasoline engine without any material change being made in the line-shaft arrangement. The motor is now belted to a pully which is mounted on a horizontal shaft which carries three other pulleys. Two of these pulleys drive a 26-inch attrition mill by the twisted-belt method. The third pulley drives a cob crusher. Two elevators are operated, one carrying the crushed material up to a receiving screen, while the other elevates the ground product. Tests over a period of several weeks show the maximum demand to be 70 kilowatts and the current consumption per bag of feed ground 0.87 kilowatt hours, if 60 bags per day are ground.



Electric Oven for Testing Manufactured by Despatch Manufacturing Company.

Mill "B" contains new equipment, having been in service only four months. A 72.5-horsepower load is connected. A 50-horsepower motor drives a 26-inch attrition mill. The remaining 22.5 horsepower is distributed about the mill for elevating and other purposes. A coal business is run in connection with the grist mill and some power is used for elevating coal. Tests on this plant showed the average consumption per bag of feed ground to be 1.1 kilowatt-hours.

Mill "C" contains a 40-horsepower motor. A test conducted from October 8 to October 26 showed a total of 932 bags ground with a consumption of 600 kilowatt-hours, or 0.63-kilowatt-hours per bag of feed ground. It may be of interest to state that in the territory in which these three mills are located the maximum income per bag of feed is six cents.

Flour and Grist-Mill Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

The Albany Mill & Elevator Company, Albany, Ore., millers of high grade wheat flour. Group drive. Running hours per week, 54.

Total connected horsepower, 50; total number of motors installed, 2; average kilowatt-hours per month, 5,785; average kilowatt-hours per month per connected horsepower, 115; load-factor, 21.4 per cent; operating time load-factor, 41 per cent.

Kilowatt-hours per month for six months (1911): January, 6,850; February, 4,080; March, 5,410; October, 6,500; November, 6,500; December, 5,370.

MOTOR INSTALLATION

The following is a list of the motors installed in this plant, with their respective drives:

No.	Horse-power	Speed	Application
1	30	1,200	Belted to a line shaft driving one milling separator, three sets of 7 by 20-inch rolls, one set of 9 by 18-inch rolls, one bran packer, one six-inch scalper, two packers, one purifier, one size 0 centrifugal reel, one size 1 centrifugal reel, one size 1 scourer, one size 0 sifter, and one dust collector.
1	20	1,200	Belted to a line shaft driving two receiving separators and one roll for chapping.

All of the above machinery was manufactured by Barnard & Leas Company. The capacity of this mill is 60 barrels of flour per day. The average output for six months was 450 barrels per month. The average kilowatt-hours consumed per barrel of flour was 13. Sixty-cycle, three-phase energy, at a potential of 220 volts is supplied by the Oregon Power Company.

Michigan Milling Company, Ann Arbor, Mich., millers of "King Roller" and "White Loaf" flour. Group drive. Running hours per week, 144. Usually for about three months each year the running hours per week are 60.

Total connected horsepower, 105; total number of motors installed, 2; average kilowatt-hours per month, 27,857; load-factor, 48 per cent.

The capacity of this mill is 240 barrels per 24-hour day. The current consumption per barrel of output, tested for a continuous period of three months, was 10.5 kilowatt-hours.

Kilowatt-hours consumption for 12 months: January, 30,180; February, 30,750; March, 31,860; April, 20,970; May, 19,830; June, 23,990; July, 20,229; August, 24,310; September, 26,730; October, 43,690; November, 36,690; December, 25,060.

MOTOR INSTALLATION

The following is a list of the motors installed, with their respective drives.

No.	Horse-power	Speed	Application
1	75	900	2,300-volt, three-phase, 60-cycle induction motor belted to shafting driving four grain cleaners, nine double-stand roller mills, 26 stands of three-inch-bucket elevators, four purifiers, three sifters, five dust collectors, four reels, two dusters, one scroll machine, five flour packers and one feed packer.
1	30	1,200	220-volt, three-phase, 60-cycle motor driving one feed roll, one corn sheller, one separator and four stands of elevators.

The Michigan Milling Company also operates a 170-barrel flour mill in which the same motor equipment is installed. Energy for both installations is supplied by the Eastern Michigan Edison Company.

Plant "A." Feed mill located in Western Pennsylvania. Energy is supplied by the West Penn Electric Company. This mill handles approximately 8,000 bushels of grain per year. Group drive. Running hours per week, 54.

Total connected horsepower, 20. One motor is installed having a maximum demand of 25 horsepower. Average kilowatt-hours per month, 149; load-factor, 1.4 per cent; operating time load-factor, 3.2 per cent.

Kilowatt-hours per month for 12 months: January, 143; February, 130; March, 176; April, 186; May, 136; June, 177; July, 112; August, 174; September, 143; October, 157; November, 125; December, 135.

The approximate total electrical energy consumption per 100 bushels of grain is 1.8 kilowatt-hours.

MOTOR INSTALLATION

The following is a list of the machines in this plant. The motor is a 500-volt compound-wound direct-current machine.

No.	Horse-power	Speed	Application
1	20	600	Belted to a 19-foot, three-hanger shaft and two three-foot, two-hanger shafts driving one 3,000-pound Crane freight elevator, one Nordyke & Marmon hexagonal scalper, one 24-inch grindstone, one 10-bushel feed mixer, one 12-inch-roll grain chopper and one 25-foot bucket conveyor having a capacity of 500 bushels per hour.

Flour and Grist-Mill Data—Sheet No. 2.

Faulk Brothers Company, East Liverpool, O. This plant makes wheat and buckwheat flour and grinds feed. Group drive. Running hours per week, 60. The plant produces 25 barrels of flour a day and grinds approximately four tons of feed. Five men are employed.

Total connected horsepower, 83; total number of motors installed, 5; average kilowatt-hours per month, 5,990; load-factor, 13 per cent; operating-time load-factor, 26 per cent.

The kilowatt-hours consumption for a period of three months is as follows: November, 5,140; December, 6,270; January, 6,560.

MOTOR INSTALLATION

The following is a list of the motors installed with their respective drives. All motors are of the slip-ring type, two-phase, 60-cycles, 220-volts.

No.	Horse-power	Speed	Application
1	30	1,150	Belted to a 31-foot, eight-hanger line shaft driving one 9 by 18-inch double-stand feed mill, one Monarch, size 5, No. 20 cracked-corn mill, one G. T. Smith No. 3 scalper, one Monarch 48 by 36-inch corn sieve, one Monarch No. 698 grain separator, and three seven-inch-bucket elevators.
1	30	1,150	Belted to a 64-foot 16-hanger line shaft driving four Monarch 9 by 18-inch double-stand flour mills, two Monarch flour packers, packing one-eighth-barrel bags, one American No. 4V blower, operating at 2,080 revolutions per minute, for dust-collecting system, one Monarch, size 0, bran duster, one Whitmore, size 2, middlings purifier, one Monarch, style E. sieve bolter, one Monarch, size 3, centrifugal flour reel, operating at 200 revolutions per minute, one 24-inch by six-foot flour reel, operating at 200 revolutions per minute, one Monarch, size 1, scourer, operating at 690 revolutions per minute, 14 six-inch-bucket elevators and two eight-inch-bucket elevators.
1	15	1,150	Belted to a 15-foot, six-hanger line shaft and counter shaft driving one 12-inch, 96-foot screw conveyor, operating at 70 revolutions per minute, one Monarch, size 4, grain cleaner operating at 580 revolutions per minute, one Monarch, size 3, grain cleaner operating at 600 revolutions per minute, and four eight-inch-bucket elevators.
1	8	1,080	Direct-connected to an Otis 2,000-pound freight elevator.
1	3	1,700	Squirrel-cage motor belted through a six-foot shaft to a hay elevator.

Energy for this installation is supplied by the East Liverpool Traction & Light Company, East Liverpool, Ohio.

Davidson Mill & Elevator Company, Muskogee, Okla. Does a general milling business. Group drive. Running hours per week, 24.

Total connected horsepower, 125; total number of motors installed, 2; average kilowatt-hours per month, 3,394; average kilowatt-hours per month per horsepower connected, 27; load-factor, 5.1 per cent; operating time load-factor, 26 per cent.

Kilowatt-hours per month for 12 months: January, 4,784; February, 3,480; March, 4,020; April, 3,960; May, 4,680; June, 2,130; July, 3,490; August, 2,470; September, 2,640; October, 3,620; November, 2,626; December, 2,828.

MOTOR INSTALLATION

The following is a list of the motors installed, with their respective drives. Both motors are three-phase, 60-cycle machines, operating at 220 volts.

No.	Horse-power	Speed	Application
1	50	1,800	Belted to line shaft driving two double stands of 9 by 24-inch rolls, one bran packer, and four six-inch-bucket elevators.
1	75	1,800	Belted to a line shaft driving one corn sheller, having a capacity of 1,000 bushels per hour, one 12-inch-bucket elevator, one four-inch-bucket elevator, one cleaner and one chop mill having a capacity of 1,000 bushels per hour.

The capacity of the rolls is 400 barrels per 24-hour day. Both of the motors in this installation are too large for the present equipment. Energy is supplied by the Muskogee Gas & Electric Company.

Johnson & Marquis, Enid, Okla. Grain dealers. Group drive. Running hours per week, 30.

Total connected horsepower, 25; total number of motors installed, 2; average kilowatt-hours per month, 758; load-factor, 5.6 per cent.

Kilowatt-hours consumption for 11 months: January, 960; February, 1,130; March, 640; April, 420; May, 520; June, 190; July, 1,357; August, 670; September, 1,070; October, 670; November, 720.

MOTOR INSTALLATION

Motors in this installation are three-phase, 60-cycle, 220-volt machines.

No.	Speed	Horse-power	Application
1	10	1,200	Direct-connected to No. 5 oat clipper, capacity 225 bushels per hour.
1	15	1,200	Belted to line shaft driving No. 5 separator; No. 5 duster; one 9 by 18-inch burr mill, capacity 150 bushels per hour; three elevators; one corn separator, one corn sheller, capacity 350 bushels per hour, and one car loader.

Commercial Practice
Management, Rates, New Business

STAFF CO-OPERATION TOWARD BETTER RELATIONS AND INCREASED EFFICIENCY OF EMPLOYEES.

By W. R. Molinard.

Co-operation between employees of a public-service corporation is absolutely essential to insure the accomplishment of the company's duty toward the community it serves. Mr. Molinard, manager of the Oklahoma City Gas & Electric Company, tells in this article how co-operation has been effected in the Oklahoma City company. This is an abstract of a paper presented at the recent Byllesby convention in Chicago.

That the subject expressed in the title of this paper is one of great importance to the continued welfare of our various organizations is, I am sure, conceded by every one.

There is perhaps no greater aid to the managers of public-service corporations and their lieutenants in accomplishing their common duty toward the communities they serve, than the sense of satisfaction which results from the confident assurance that the men composing the working force of their organization know that they are being conscientiously, honestly, intelligently and ably guided by leaders who hold the welfare of their men on a par with their more apparent responsibility of dealing satisfactorily with the public; and consequently that the men will show their appreciation of fair treatment in giving their loyal support to the management.

I am strongly inclined to compare the American workman, be he skilled or unskilled, to the American soldier.

As a result of the deep study which our highest and most competent military authorities have given to the subject, the principle of developing and encouraging a man of the ranks to become a reasoning, self-reliant, intelligent and initiative unit of the organization, has become familiar to all of us. And we all know that as a further result foreign military authorities concede the present type of American soldier to be "head and shoulders" above the type that is found in other countries.

This method being pursued by our military authorities, our soldiers are none the less amendable to discipline, and to making up the personnel of efficient bodies of troops, but on the contrary they fully appreciate that their officers are appealing to their intelligence and initiative, and there is no doubt but what it results in getting men who conform all the more readily and cheerfully to discipline because their minds are trained, and they are capable of understanding that discipline is paramount in getting best results.

Now let us turn to the American workman, who follows a more prosaic career, perhaps, but nevertheless a career that is filled with serious obstacles that must be overcome.

We find in the workman these same traits of self-reliance, courage, cheerfulness and initiative highly developed, and they are among the most desirable qualifications that can possibly be found in our employees. But these traits must be properly trained, and at times some of them restrained, in order that they will contribute to the very best results in our commercial organizations.

It is with the highest development of these desirable qualities in our men, therefore, that we should be most earnestly concerned, with the purpose in view that first we may maintain and constantly improve the already enviable reputation of the "Byllesby Companies" for efficiency and progressiveness, and also that we do our whole duty to those who look to us for guidance and example in making themselves more efficient, and who thus contribute their part toward the same end.

Inasmuch as "staff co-operation with employees for better relations and increased efficiency" has been given considerable attention by the Oklahoma City company, and our "Mutual Advancement Club" has been in active existence since April, 1911, it may be of interest to learn something of this club's inception and progress.

The club is fortunate in having an ample-sized assembly hall, with library attached, for its meetings, on the second floor of the new office building at the plant, which was provided for through the foresight that was displayed at the time this building was erected. This hall is equipped with suitable rostrum, folding chairs, blackboard and projecting lantern and screen, with one end of the room curtained off as a refreshment space, which is equipped with a gas stove and coffee urn, and tables and table ware. The first preliminary meeting to organize the club was called, for the night of April 26, 1911, and, followng the usual procedure of a political convention and after F. H. Tidnam as spokesman had explained the purpose of the organization, a temporary chairman and secretary were selected. The name of the club was decided upon and the chairman appointed a Committee on Constitution and By Laws, and one on Entertainment, to report at the next meeting.

Each man present then arose in turn and introduced himself, giving the department to which he belonged. This was done because in the Oklahoma City company we have some 270 employees, and many of the men in one department did not know men in other departments, even by sight, to say nothing of their names.

At the next meeting the constitution and by-laws for the club, as drawn up and submitted by the Committee, were read as a whole, then re-read and discussed section by section, and adopted.

A president, vice-president, financial secretary, recording secretary, treasurer, sergeant-at-arms and messenger were then elected, as well as an executive board, The president then appointed a Program, an Entertainment, and a Question Box Committee, and after the club disposed of other routine business, it adjourned for refreshments.

During the subsequent semi-monthly meetings which have been held, various papers have been presented by the members, and occasional visitors.

In all of the papers, where it was practicable, the salient points were emphasized by demonstrations with actual apparatus and appliances, and a supply of electric current was available, or illustrations were projected on the scene, and diagrams were made on the blackboard.

An appreciable part of our club evenings is often taken up by questions or suggestions that find their way before the club through the Question-Box Committee, which has receiving-boxes placed in suitable locations at the uptown office and at the plant.

After the more serious matters before our club meetings are concluded it is our custom to adjourn to the refreshment end of the hall where the

Entertainment Committee has provided light buffet supper, including lemonade or coffee, and often topped off with a "smoke on the club."

We feel that the social session part of the evening gives us a chance to "talk it over and get acquainted" in a much better way than can be found at any other time, and it is sure to create a friendly bond between all the men of the different departments who are at work under the company name, and who thus come into informal contact with one another. We encourage a reasonable amount of informality during the meetings, especially in summer.

As to financing our club, our dues are twenty-five cents per month, and the club does not depend upon any other source than the membership dues for its funds. Our financial secretary issues a membership card bearing the member's name, and with the names of the months printed around the margin. His punch cancel in any month signifies the receipt of dues for that month so that a member's card is a constant reminder to come to meetings, "to time and to turkey."

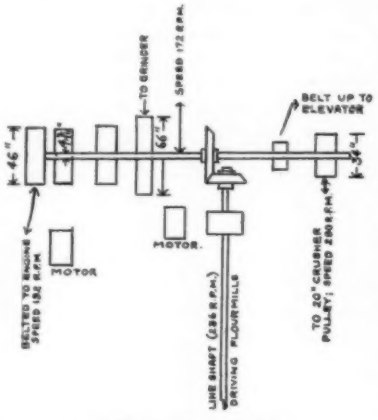
Our library is at present practically limited to the technical periodicals pertaining to our business, but these are supplemented by subscriptions to some of the popular magazines, and the library already boasts a few bound volumes. It is conducted under the general supervision of the club, and is open on week days from 8 a. m. to 10 p. m.

Both at our meetings and on the outside, the management and staff encourage the men to developing their individuality, initiative and personal acquaintance, for we believe that these qualities do much to develop the good that is in them, and we know that a man wants to stay with an organization where he can reach his highest efficiency. In encouraging the men on the "firing line" the writer would recommend to managers and staffs to infuse into their employees a spirit of optimism, and to encourage suggestions from them. Get them to cultivate, and cultivate yourselves, the general use of the pronouns "we", "ours" and "us" between yourselves and your employees. Adhere, as far as it may be consistent to the best interests of your company, to line promotion within the ranks. Encourage any of the men who may develop ideas or inventions that may contribute to the betterment of our business, and when a reasonable subject is brought before department heads, don't pigeon-hole it. Give it a definite and satisfactory reply and within a reasonable time. There have been many valuable ideas and suggestions brought before managers that have died an unnatural death for want of a fair hearing.

QUICK ACTION OF CENTRAL STATION AFTER BOILER EXPLOSION.

By Theodore Blech.

By offering an "off-peak" rate, the Public Service Company of Northern Illinois endeavored to obtain the business of all the gristmills in its territory. A systematic campaign was started and after little effort, by pointing out the advantages of electric motors over steam



Line-Shaft Arrangement.

and gasoline engines, a large percentage of the business was secured. In one particular instance the mill was driven by an ancient plain slide-valve engine that recently had been overhauled. The engine was rated to develop 35 horsepower and was in fair condition in spite of its age, but the attendant complained that he experienced considerable trouble in maintaining the steam pressure of 60 pounds. Also, it was found from observation that the engine could not drive grinder and flour mills simultaneously so that the owrk could not be carried on in both departments. The grinder was an old 24-inch Waldron (stone) grinder and the mills comprised three 14-inch double and two 20-inch single, with cleaner, shakers, etc. It was suggested to the owner to purchase an attrition mill and to drive each lineshaft separately, as it would only be a question of time until the boiler would have to be abandoned. Nevertheless he hesitated for some time before deciding on the matter, poohpoohed all warnings that the boiler was hardly able to stand any pressure very much longer and took his time about selecting grinder and motors. The central station finally decided to await matters, which developed quicker than expected.

It appears that the regular engine attendant had been discharged and that the man in charge of the mill had attempted to run the engine, fire the boiler and attend to the milling business until the arrival of the new engineer. In the rush of business, he let the boiler run dry, decidedly unhealthy both for engineer and boiler, and in a short time the unavoidable accident had happened and the boiler exploded.

It was here that the central station established a record for giving quick service. As grinding had to be resumed as speedily as possible it was decided to install one motor for temporary service until all necessary changes could be made.

The accompanying layout shows the line shaft arrangement. The engine was belted to a 46-inch line pulley making the speed of the main shaft 172 revolutions per minute. The 66-inch pulley drives the grinder, while the shaft driving the flour mills is connected to the main shaft by means of bevel gears. The latter shaft was disconnected and a 25-horsepower, 900-revolutions-per-minute squirrel-cage motor was belted to the main pulley, which was moved towards the right about four feet, to permit the mounting of the motor on wooden beams. The line gang and the wiremen were busy simultaneously, so that within 24 hours the mill was running again.

Visit of Officers to Appalachian Power Company District.

The district which the Appalachian Power Company will serve in Virginia and West Virginia was visited during the week of January 29 by the officers of H. M. Byllesby & Company, and Messrs. Viele, Blackwell and Buck. The party included Mr. Byllesby, Mr. Huey, Mr. Osthoff, Mr. O'Brien and Mr. Stearns. R. G. Hunt and E. L. Callahan also spent the week at this property. The occasion of the visit of the officers called forth publication of several columns of matter in the Bluefield press, all of a very favorable nature. The Chamber of Commerce held a reception in honor of the visitors during which the latter met many of the leading business men of Bluefield and the vicinity. Interviews by Mr. Huey and Mr. Osthoff expressing the greatest confidence in the industrial development of the section and the power enterprises appeared in the Bluefield *Daily Telegraph*.

Reduced Rate in St. Louis.

The Union Electric Company, St. Louis, Mo., has been giving a reduced rate only to those customers who came to the office and signed a contract for that purpose. It has recently been decided, however, to make a rate of 11 cents per kilowatt-hour a maximum rate for all customers and bills made out after February 1 will be based upon the new rate. The rate of 9.5 cents which was made by the Act of Assembly has not been enforced, owing to the fact that the matter is now being settled in court.

Electrical Construction

NOTES ON ELECTRICAL CONSTRUCTION.

By George J. Kirchgasser.

This is the seventh of a series of articles on electrical construction, treating in a thoroughly practical manner every phase of construction usually encountered by the electrical contractor or the electrician in an industrial plant. This article discusses in detail some further types of electrical fittings.

Attachment Plugs.

Attachment plugs are used with flexible cord for connecting portable lamps, desk lamps, fans, heating devices, and portable motors to the circuit wires. The plugs formerly in greatest use, were of a single piece

Fig. 1—Trumbull Surface Molding Rosette.

and were screwed into the ordinary socket or receptacle. This twisted the cord, however, and any strain on the cord was imparted to the fixture.

Separable attachment plugs, consisting of a cap and base, are now used almost exclusively. Various makes differ somewhat, but all are similar. When used the base is first screwed into the socket or receptacle and

Fig. 2—Freeman Rosette.

then the cap is pressed into the contact clips which convey the current to the cord. The ends of the cord are secured to two small brass screws in the cap and a knot is placed in the cord, in the same way as in sockets and pendent switches, to take the strain from the binding screws. A strain on the cord causes the cap to separate and therefore insures the fixture and the cord as well against any probable injury to either one of these.

The rating of the ordinary plug is 660 watts, 250 volts; that is 3 amperes, 220 volts or 6 amperes, 110 volts. Standard plugs should not be used on a system having a voltage in excess of 250. For higher voltages or higher

Figs. 3 and 4—Weber Universal Key and Keyless Sockets.

ampere capacities special plugs made for the purpose should be employed.

Rosettes.

Rosettes are usually used for suspending pendent lamps by means of flexible cord. The rosette simply furnishes the means for properly connecting the two conductors of the flexible cord to the circuit wires. A Trumbull molding rosette is shown in Fig. 1 and another type is shown in Fig. 2.

With this fitting, also, the cord is knotted before passing through the hole so that strain will not be put on the binding screws of the rosette. Fuseless rosettes are usually employed.

In industrial plants fused rosettes have been used somewhat in the past but their use now is decreasing. Where many small 660-watt circuits were not desired, 40 to 50 sixteen-candlepower carbon-filament lamps, each suspended by a fused rosette, were put on a sin-

Fig. 5—Paiste Pull Socket.

gle circuit of No. 8 or No. 10 conductors. This construction was allowed where the circuit was limited to such a size as to be protected by 25-ampere fuses. Where the voltage of the system does not exceed 125, link fuses of two-ampere capacity are allowed in

Fig. 6—Pass and Seymour Composition Socket.

the rosette, but for over 125 and up to 250 volts, inclosed fuses are used.

Sockets.

Brass-shell (key and keyless) porcelain and composition sockets are made. Figs. 3 and 4 show the three parts, cap, body and brass shell of the Weber Universal key and keyless sockets. On each side of the porcelain body there is a contact screw for securing

the fixture wires or ends of the flexible cord which enter through the upper hole in the cap. The brass shell and cap are both lined with insulating fibre. Another figure shows a Paiste pull socket which has the same general construction.

The hole in the cap is threaded for one-eighth-inch or three-eighths-inch pipe. For ordinary flexible cord the one-eighth-inch cap is satisfactory when provided with a small hard-rubber bushing. Where reinforced cord is used, as for a portable lamp, a cap

Fig. 7—Electrolier Insulating Joint with Hickey.

threaded for three-eighths-inch pipe and provided with a bushing with a 13-thirty-seconds-inch hole must be used.

The standard brass shell key or pull socket with slow make and break is now rated at 250 watts, 250 volts, with a maximum current of 2.5 amperes. Keyless sockets are rated at 660 watts, 250 volts, with a maximum of six amperes. Weatherproof porcelain and composition sockets are rated at 660 watts, 600 volts.

Brass-shell sockets are not satisfactory for outside use, for basements, breweries, packing houses, etc. The ordinary key socket should not be used where there is dust, as in cereal mills, planing mills, or buffing rooms, or where there is moisture, vapors or gases. Brass-shell keyless sockets with tight-fitting shell are well adapted for

Fig. 10—E E B Canopy Insulator.

dusty and linty locations because they are stronger than a porcelain socket. For use on fixtures brass-shell, key, pull-chain and keyless types are used almost exclusively.

Grounds and short circuits in key sockets often occur through water entering the key slot. This is liable not only in damp locations but where a key socket is located over a wash bowl. The key is often manipulated when the hand is wet and water runs into the shell. A pull-chain or keyless socket operated by a canopy switch is better for over a wash bowl.

Weatherproof sockets are used where moisture vapors and inflammable or explosive gases are present. Double-braid rubber-covered wire is run directly to the lamp socket. The globe excludes all vapors from the socket. A half-inch pipe for which the socket is threaded is used as the bracket arm.

This same construction is used for outside doorways and in damp locations without the vaporproof globe. A porcelain waterproof keyless socket is used. This kind of construction is employed to a considerable extent with conduit systems.

With an open knob system the wires

Fig. 8—Macallen Insulating Joints.

of the long pendants are twisted together to form sort of a flexible cord. Waterproof pendent sockets installed in this way are used in brewery, abbatoirs outside, and in other damp locations. No. 14 stranded rubber-covered wire is used so as to be more flexible. Knobs supporting the sockets are so placed that pulling on the sockets will not put any strain on the connections to the circuit wires. Fig. 6 illustrates a composition waterproof socket. Porcelain sockets are somewhat cheaper, but composition sockets, being mechanically stronger, are better

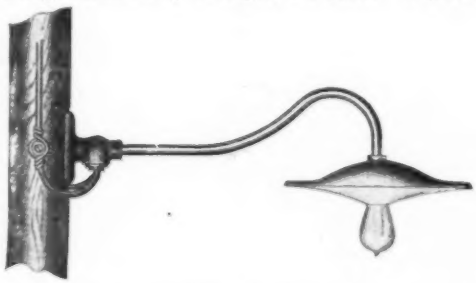


Fig. 11—Special Pipe Hanger.

for locations where objects are apt to come in contact with them.

Fixtures.

When electricity was not so universally used, when central stations were smaller and the service was liable to interruptions, combination gas and electric fixtures were used extensively. If the electricity failed the gas was used. Even with the satisfactory service now supplied the old custom of installing combination fixtures still has a strong hold on the public. In the last two years, however, straight electric fixtures have been used more than in a ten-year period before.

A combination fixture has the gas pipe inside an outer brass shell and the wires are run in the inclosed space. Because of the small wire used (No. 18 or No. 16 B. & S. gauge) and because of the intimate contact with the metal of the fixture only rubber-covered wire should be used.

The fixture is really the weakest link in an interior lighting system and their construction and installation should be carefully executed. Where the fixture wires are brought out of the shell for connection to the circuit wires in the canopy, a fitting as a

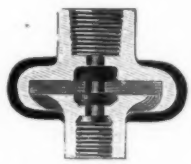


Fig. 9—Section of Insulating Joints.

"hickey" (see Fig. 7) or a crab is employed. The insulation is sometimes apt to be cut in time by contact with the edge at the place where it leaves the shell. After soldering rubber tape should be tightly wrapped about the wire and then friction tape is used to hold this in place.

Insulating joints, several of the Macallen make of which are shown in Fig. 8, are used to insulate the fixture, gas pipe, shell and all from the gas pipe system. The gas piping as it is connected to underground mains is grounded and it is not safe to con-

Fig. 12—Condulet Fitting.

nect a fixture directly to the pipe because of the possible leakage of current. The cross-section view (Fig. 9) shows the means of separation. Hard-rubber composition formed under great pressure is used as the insulating material and this is not affected by the gas passing through it.

In fireproof buildings or wherever the canopy comes in proximity of current-carrying materials, as steel ceilings or walls, or where metallic lathe is used, canopy insulator rings must be used. The method of applying an E. E. B. ring without use of rivets is shown in Fig. 10. Some in-

sulating rings are made that are not secured to the canopy, but in case the canopy becomes loosened are apt to drop out.

As the canopy is secured to the stem of the fixture the reason for insulating the canopy as well as the fixture stem (by the insulating joint) is readily apparent. With straight electric fixtures, in which there are no gas pipes, insulating-stud supports are used and canopy insulators are also necessary if in contact with any metallic material liable to be grounded. In conduit systems, however, if the double-braid rubber-covered wire goes directly to the waterproof socket, no joint or stud is needed to insulate the hanger arm.

A small piece of flexible tubing is wrapped around the gas pipe behind or above the insulating joint. This insures keeping the splices which are usually wrapped about the pipe from direct contact with it. This is the case on a knob and tube system, but on a conduit system or where outlet boxes are used the gas pipe passes through the bottom of the box and the splices are made in the box.

Except special pipe hangers or other waterproof fixtures, no fixtures should be installed outside or in other damp locations. Ordinary types of fixtures, sockets, etc., are not adapted for use on circuits where the voltage exceeds 300. Fig. 12 shows a Crouse-Hinds condulet fitting for use with outside lights such as are illustrated in Fig. 11.

Before turning over an electrical installation, insulation resistance tests for grounds should be carefully made. A small hand-operated magneto or a "megger" can be used at different outlets and fixtures. Tests between conductors, between each conductor and the fixture, conduit (if a conduit system), gas pipe, etc., should reveal any defects. Ringing of the bell means that the insulation somewhere is imperfect.

The following table gives the insulation required by the National Electrical Code:

Maximum Amperes	Insulation between conductors and between conductors and ground with fuses, cutouts, etc., in place.	Insulation between conductors and between conductors and ground with fixtures, sockets, receptacles, fuses, etc., in circuit.
	Ohms.	Ohms.
5	4,000,000	2,000,000
10	800,000	400,000
50	400,000	200,000
100	200,000	100,000
200	100,000	50,000
400	50,000	25,000
1600	12,500	6,250
800	25,000	12,500

Charles R. Kreider.

Charles R. Kreider, whose photograph appears in this column, is business manager of Kohler Brothers, electrical contracting engineers, 343 South Dearborn Street, Chicago. Mr. Kreider entered the employ of Kohler Brothers in 1893, taking then a minor position with the firm. By close attention to his duties and through a diligent and persistent study of the electrical contracting business, he won rapid promotion and likewise speedily gained a place of prominence and great usefulness among his associates in the field of contracting. Moreover, a genial disposition and a temperamental optimism have made all of his acquaintances his friends. There is indeed perhaps no man in his section of the country more widely or more favorably known among contractors than is Mr. Kreider.

He is president of the Chicago Association of Electrical Contractors; was formerly first vice-president of the National Electrical Contractors' Association;

Charles R. Kreider.

and is a member of the Educational Committee of the Electrical Contractors' Association of the State of Illinois, in which last organization he has held various other positions of honor and trust. He is also a Jovian—of potential 1590, and is a prominent member of the Electric Club of Chicago.

Kohler Brothers, the firm with which Mr. Kreider is associated, are known the world over as the inventors of the Kohler system of printing-press control, their apparatus for the control of the speed of motor-driven printing presses being now manufactured by the Cutler-Hammer Manufacturing Company, and sold extensively in all civilized countries. Scarcely less important to them, however, is their electrical contracting business. Within the last twelve years, during which time Mr. Kreider has been the business manager, the firm has done many of the largest jobs of electrical construction in the country, these jobs including such electrical installations as that in the Chicago & Northwestern Railroad Terminal Building, at Chicago, which was only recently completed.

ELECTRICAL WIRING IN DRY KILNS.

By H. G. Wilson.

The proper method of wiring dry kilns and other excessively hot places is a disputed one, but the fact remains that rubber-covered wire is of little practical value in either open work on knobs or cleats or in conduit, as after a comparatively short time the rubber is thoroughly dried out to the extent of becoming brittle and crumbling to the touch.

Dry kilns are usually constructed of brick and iron frame-work. It is the result of experience that wooden blocks fastened to the brick walls and frame-work for the support of insulators and conduit, shrink to quite an extent and in some places char with the heat, and, as a consequence, they become loose and furnish but a very poor support, the wires falling down and becoming a continual source of trouble.

The National Electrical Code rules depend upon porcelain and spacing distance in open work and a well grounded system in conduit work for the ultimate safety of Class C wiring, rubber constituting a variable factor which deteriorates in time with age, heat, etc.

In order to benefit by previous experience as much as possible, rubber-covered wire, wooden blocks and conduit were eliminated altogether from consideration in making a certain dry-kiln job. So asbestos-covered wires separated six inches from each other and not less than one inch from the surface wired over were installed, with supports every 4.5 inches on split knobs fastened securely to the iron frame-work with bolts, holes being drilled through so that nuts held them in place and, where this was impossible the holes were drilled and tapped with threads corresponding with those on the bolts. For running the wire on brick side walls, iron brackets were made for the support of the knobs.

Porcelain wall sockets were used where practicable. For drop lights another Code rule had to be "stretched," as No. 14 solid asbestos-covered wire had to be used, since at the time stranded wire of this size and kind could not be obtained; so the drop wires were permanently separated from their joints on the circuit wire to the porcelain sockets by cleats held together by stove bolts, thus giving a 2.5-inch separation, and the taps were anchored by split knobs, one for each wire.

Fuses, switches and cutout cabinets were placed outside of the kilns. Hence all of these appliances were of the kind usually employed.

THE GROUND CONNECTION IN LIGHTNING PROTECTIVE SYSTEMS.[1]

By E. E. F. Creighton.

Three Elemental Properties of the Earth Connection.

This matter can be clarified only by an analysis of the requirements in each case. Before that is done, however, it is useful to note that the three main elements of interest in an earth connection are the resistance, inductance, and a condition which, for want of a better name, may be designated as the electro-static capacity factor or equalizing connection.

In regard to the resistance, its constancy may be affected, either gradually, by droughts, freshets, freezing and such other changes as naturally attend the seasons; or suddenly, by the heat given out by an electric current passing to ground. Furthermore, in regard to the resistance of an earth connection, its laws differ from the ones we are accustomed to use. For example, we are accustomed to think that if the area of cross-section of the conductor is increased, the resistance will be correspondingly decreased. However, doubling the area of a pipe-earth by increasing the diameter does not reduce the resistance to earth by one-half; in fact, by such a change, the resistance to earth may be decreased by only a small percentage. If not in a reduction of resistance, what, then, is gained by an increase in area? This is a question that must be answered. Also how can the earth resistance be reduced? And why not by doubling the area of a single earth-plate?

In regard to the earth connection, there is still another factor of an unusual nature that must be taken into account, viz., its permanency or life. When a conductor is installed overhead, its oxidation is of negligible value even after many years of use and the electro-chemical action is sensibly nil. In an earth-connection, however, conduction is naturally by electrolysis, which produces a dissociation of the materials; and, furthermore, the metal parts are subject to the chemical action of the soluble ingredients of the moist earth. Still further there is a great difference in wear on the earth-plate, depending on whether the current is alternating or direct.

In regard to the second main division, viz., the inductance of earth-connections, the three main factors are length of the conductor, loops in the conductor, and multiple conductors.

There is still the third division which has been designated as the electrostatic capacity factor.

It is convenient not to follow the exact order given in the foregoing outline. It seems desirable to state, as briefly and definitely as may be done, the general laws concerning earthing, give instructions for making a pipe-earth, and then later give detailed data on which the laws are based.

Laws of Resistance of Earth Connections.

After a depth of several feet in the conducting stratum has been reached, each additional foot decreases the total resistance by one divided by depth in feet. This is explained later.

Practically all the resistance is in the earth in the immediate vicinity of the pipe. This resistance depends on the specific resistance of the material. The specific resistance depends on the amount of moisture and the electrolyte in the moisture. To get the lowest possible resistance, pour strong salt water around the pipe.

When it is desired to lower the resistance to earth below that of a single pipe-earth, drive others at distances of not less than six feet. Then the total conductance is only slightly less than the sum of the individual conductances, and the total resistance is the reciprocal of the total conductance. For condition of uniform soil, the approximate rule may be stated: That two pipe-earths connected together give one-half the resistance of one, ten pipe-earths give one-tenth the resistance of one, and so on.

For distances between pipe-earths up to one foot, the resistance increases rapidly. For every additional foot, the added resistance becomes less and less. At a distance apart of six feet, the resistance has reached nearly a constant value. Stated otherwise, the resistance between two pipe-earths at any distance apart greater than six feet is nearly equal to the sum of the isolated resistances of each.

Since the resistance of a pipe-earth lies mostly in the immediate vicinity of the pipe, the greatest potential drop when the current flows, will also be concentrated there. Heating and drying out will tend to magnify this.

The quantity of electricity that can be passed through a pipe-earth, without materially changing its resistance, increases directly with the wetness of the earth in contact with the iron, and the area of the iron surface exposed to the passage of the current; and decreases as the resistance of the earth in contact with the pipe increases. Certain critical values of current may be carried continuously by a pipe-earth without varying the resistance. The higher the current above this critical value, the more rapid the drying out. To increase the ampere-hour capacity, keep the pipe-earth wet with salt water.

The resistance of a pipe-earth does not decrease in direct proportion to the increase in diameter of the pipe. Two pipes driven side by side and connected together will have only slightly less resistance to earth than one pipe; it is therefore not surprising that a pipe two inches in diameter has a resistance only about six per cent to 12 per cent less than a pipe one inch in diameter.

Make the connecting wire as short as possible by taking as direct and straight a path as possible. The objection to sharp corners lies entirely in the fact that it is longer around two sides of a triangle than it is along the hypothenuse. A curved turn is shorter than a right-angled turn but it is not as short as the hypothenuse.

Loops in the lead introduce unnecessary impedance to high frequency impulses.

The inductance of a conductor to high frequency may be said to decrease with the increase of surface. A hollow metal tube conducts as well as a solid wire of the same circumference. A flat strip is an economical way of getting large surface with a small weight of metal. The minimum degree of inductance with the minimum weight of metal is obtained by using separated parallel wires. Copper is best on account of its conductivity and durability, but since only the surface layer of metal carries the current, galvanized iron is permissible in some cases.

General Instructions for Making a Single Earth Connection.

An earth connection is necessarily made by electrolytic conduction. To obtain a low resistance, it is therefore necessary to have electrolytic moisture in contact with the earth-plate, or, lacking thus a fair degree of conductivity, it is necessary to have a very large area of cross-section for the current. One finds no dry earths that are conductors. If the earth contains no soluble substances which conduct electricity it is necessary to add an electrolyte. The one precaution in choosing an electrolyte is to avoid one which attacks chemically the metal conductor.

It is impossible, as many know, to make a rule or practice to cover all cases; but, the general practice of using pipe-earths can be justified in nearly every case of earth-connection. Coke, so often recommended for earth-connections, is not a good conductor in itself. It attracts and holds moisture, to be sure; but since that moisture usually does not contain an electrolyte in solution, it leaves the earth-connection with high resistance. From every point of view the iron pipe-earth is to be recommended,—on the basis of first cost, ease of inspection, resistance, care, measurements, etc. Iron is the

1 Part of an article in the *General Electric Review*.

cheapest available metal; its use in water-mains has thoroughly proved its serviceability even when embedded in salty marshes. Salt or washing soda is to be recommended as electrolyte. While washing soda has less chemical effect on iron than salt, the resistance is higher. In the majority of conditions, salt is preferable.

All the fanciful ideas in "grounds" may be classed with the platinum points for lightning rods. They are both miserly ways of burying money.

Just plain pieces of standard one to two-inch pipe, driven as much over six feet as is convenient, are best (see Fig. 1). Solid metal spear-heads on a pipe, and sleeve-joints which make holes larger than the diameter of the pipe, increase the contact resistance enormously. If for any reason they are used, special precaution should be taken to fill up the space between the pipe and the earth by an abundance of salt water. If the pipe drives with too much difficulty a solid crow-bar will usually open up a hole. If there is no stand available for starting a pipe eight feet or more long, a shorter pipe, slightly larger in diameter, may be driven several feet and then withdrawn to make a start for the longer pipe.

A basin should be scooped out of the earth at the surface around the pipe, and salt brine poured in. The amount of salt water needed depends on the local conditions of the soil. Where the resistance of a pipe-earth is less than 100 ohms without salt, a bucket full of brine may suffice; where the pipe-earth does not reach moisture below, several bucketfuls may be necessary. Finally, a few handfuls of crystal salt should be placed around the top of the pipe in the basin. Whether the basin is to be filled with dirt, or made permanent by the use of a tile with a cover, depends upon the importance of the earth connection.

Earth Connections for Lightning Arresters in Electric Stations (Alternating Current) for the Usual Conditions.

Drive two or three iron pipes into the earth at a point nearest the location of the arrester; then drive other pipes which encircle the station, and connect all of them to a common wire. The minimum distance between pipes should not be less than six feet. The resistance to earth decreases in proportion to the number of pipe-earths used. Eight pipe-earths might be considered the minimum number to use on a small station; more are desirable if the soil has a high resistivity. Ground all transformer cases and iron bases of rotary apparatus to the earth-pipes. Also connect the water-pipes to the earth-pipes.

Unusual Conditions.—Electric Stations on Solid Rock.

In a hydraulic power house, make earth connection by submersion of a metal plate in the water at a convenient point nearest the arrester, and connect this to all the metal grillwork in the fore-bay to get as large a surface exposed to the water as possible. Drive pipe-earths in the nearest soil and connect these to the other grounds.

Earth Connections for Neutrals of Electric Systems.

The requisites are large plate area exposed to the passage of the current, and a large or continuous supply of salt solution around the earth connections. In cases of accidental grounds, the earth connection is seldom required to carry dynamic current for more than a few seconds. For the safety of the line, relays should be placed to open the circuit within a few seconds, even if the accidental ground is of high resistance. If a number of distributed pipe-earths are in a soil too dry to carry the current without the possibility of drying out, there may be added a group of pipe-earths specially salted and watered. If for any reason the earth connection is required to carry dynamic current continuously, it is essential to supply salty water continuously.

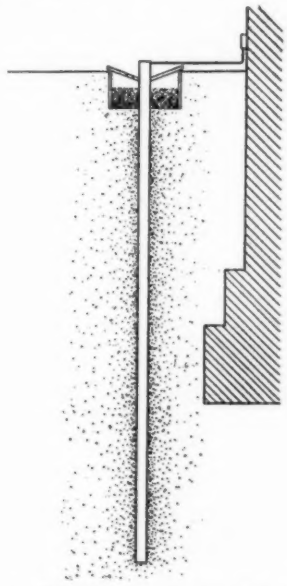


Fig. 1.—Essential Features of a Good Earth Connection.

Earth Connections for Transformers on Poles (2,300 Volts and Thereabouts.)

To get a high degree of protection, a lightning arrester should be placed on the same pole with every transformer. The ground terminal of the arrester should be connected to the iron case of the transformer, in order to avoid the drop in potential of the ground wire down the length of the pole to the earth connection. This ground wire should contain an easily disconnected joint. As a matter of safety the lineman in climbing the poles opens this joint and bends back the ends to insulate the upper parts from the ground while he is at work. The ground terminal of the arrester should be connected to the secondary of the transformer either directly or through a small gap, according to the practice followed on the secondary circuit. By following the foregoing outlined practice, any cheap iron wire down the pole may be used, and also a single pipe-earth. In cities, it is desirable to cover the ground wire with a wooden cleat or other insulation to a distance above ground of about eight feet. An accidental cross between a phase and the ground wire might dry out the earth, and if the ground wire could be touched by any one standing near on moist ground, a severe shock might be received. If the soil is especially dry, two salted pipe-earths are desirable.

Grounds for Arresters on Trolley Lines.

This is an unusual condition where earth connections are not necessary, and in some places on account of electrolysis in neighboring water-pipes and gas-pipes, are undesirable. The arrester should be grounded on the rail. The object is to keep the potential normal between the trolley and the rail, but not necessarily to the ground in the neighborhood. On account of the unavoidably long connection of the arrester circuit from the trolley, down the pole and back to the rails, the line arrester cannot, in itself, give good protection to a car. It can, however, greatly relieve the strain on car arresters. Incidentally, it protects the insulators in the neighborhood to some extent.

Grounds for Signal Circuits.

It has been the practice to use a buried coil of copper wire for a local ground near the relays. A number of signal engineers have recognized the value of using a rail for an earth connection and have used an extra gap between a rail and the local ground or earth. Measurements of the relative resistance of the local earth and a rail show that a rail, in spite of its position on wooden ties and rock ballast, has only a small fraction of the resistance of a local earth-plate. Furthermore, the rails, on account of their length, gather in the radiating earth-currents of a lightning stroke. It seems reasonable to presume that an induced potential from electrostatic charges will exist principally between the overhead wires and the rails. Protection should therefore be provided

between these two circuits. So far as the writer knows, no reason is evident why the ground terminal of a lightning arrester should not be connected directly to one rail without the use of a local earth-plate. So long as the lightning arrester is shunted across the coils and contacts to be protected, the inductance of the length of rail is a factor that does not enter the problem of protection. At any rate, even when a local ground is used, there should be a lightning arrester connection to a rail.

Earth Connections for Telephone Arresters.

A pipe-earth or rod-earth is usually sufficient. The earth-connection should be capable of carrying the current of a series arc circuit without drying out. In case of such an accidental cross, the fuses protecting the instrument will not, and should not, melt and open the circuit. It is necessary for the earth connection to maintain a fair degree of conductivity in order that the potential at the telephone receiver may be kept down to a safe value.

A Campaign for the Education of Electrical Contractors in Illinois.

The committee recently appointed by the Electrical Contractors' Association of the State of Illinois to consider means for the better education of the members of the Association in matters of estimatting and cost-keeping in electrical contracting, is busily engaged in collecting data to be used in this educational work. Letters are being sent to the more prosperous and progressive contractors over the country asking them for descriptions of their systems of keeping costs and of estimating on prospective jobs. It is probable that from these data and from the ripe experience of the members of the committee themselves something like standard systems of estimating and cost keeping will be evolved, and that a man will be engaged to visit Illinois contractors and explain these systems to them personally.

The committee will meet in Chicago on February 19 to consider these matters in more definite detail. The members are J. T. Marron of Rock Island, and William McGuineas, W. J. Collins, J. N. Pierce, Charles R. Kreider, and F. L. Decker, all of Chicago.

Short-Circuiting Caused by Raven's Nest.

A raven's nest made of 255 pieces of rusty copper wire was recently discovered as the cause of short-circuiting on one of the telephone lines near Cananea, Mex. The nest was built on a cross bar of the pole, resting on the wires, and the pieces of copper of which the nest was built stretched from one line to another.

LETTERS TO THE EDITOR.

Connecting a Lamp Between Opposite Wires of Two Two-Wire Circuits.

To the Editor:

I shall have to criticize the "Wiring Kink" entitled "Special Wiring for Hall-way Lights," which appeared in your issue of January 27.

Question No. 155, on page 897, of the December issue of *Electrocraft*, which was submitted to the Executive Committee of the National Electrical Inspectors' Association, reads as follows: "Is it permitted to connect a load between the opposite wires of two two-wire circuits, as shown in Fig. 1?" Out of nine printed answers to this question, seven flatly said no; and the other two objected to the wiring, but did not find it positively prohibited by the code. Too late for publication, four other answers were received which all unqualifiedly rejected it in every case. It is true that the figure referred to showed a full load on the circuit, instead of a single incandescent lamp, as is contemplated in the "Wiring Kink" in question; but in the case of a fully loaded circuit the addition of even one lamp makes necessary the overfusing of one side of each of the two circuits between which the lamp is connected. In view of this and of the question and answers referred to above, I feel that the plan should not receive the approval of inspectors, and it could certainly hardly expect it in the large jurisdiction represented on our Executive Committee.

WILLIAM LINCOLN SMITH,
Municipal Inspector of Wires.
Concord, Mass., January 29, 1912.

Uniformity in Inspection Requirements.

To the Editor:

I note in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of January 20 some interesting remarks by William A. Murray.

I believe that the difficulty he finds in the lack of uniformity in methods of inspection and in requirements, especially in the smaller towns, is now much less in evidence than it was a few years ago. But it can never be entirely overcome until we get all of our inspectors to regularly meet with other inspection departments, and to learn the value of real uniformity. Even then uniformity should not mean, and I do not believe that Mr. Murray would wish to have it mean, a settling down to an immovable standard, which allowed of no further restrictions if their desirability should be proved or the advance of the art should demand them. There must always in inspection, as in construction, be some pioneer work. Without it, we should never have arrived at the very much better inspection methods as well as construction methods which are evidenced throughout the country today.

In this good progress toward uniformity the Western Association of Electrical Inspectors has done very good work, and when it is realized that this organization, covering as it now does a great number of inspection departments in the Central, Southern and Western States, has only existed for seven years, and the period of its real influence has been considerably less than that, the lack of perfectly satisfactory inspection conditions may well be excused. The widening of the Association's influence to include the smaller town inspection departments is one of its immediate and important problems.

W. J. CANADA.
Denver, Colo., January 30, 1912.

Concerning Conduit Work.

To the Editor:

I notice in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for February 10, your editorial on "Some Abuses of Conduit Construction," in which you speak of damage to the conductors by the application of excessive force in pulling them into a run of rigid conduit.

In reference to the above, I think this could be easily overcome if the Board of Fire Underwriters would issue a rule to cover this point. I think I have covered the same in all our specifications in regard to conduit work, which read as follows:

"Care must be taken in running the conduits, as in no case will a pulling-in wire be allowed that has a tensile strength of *more than two-thirds* of the *total strength* of the conductors pulled in the conduit."

Before I inserted this in the specifications I used to have a good deal of trouble from the cause you speak of, but since then I find the contractor is very careful in selecting the size conduit, as well as the number of turns he puts in the same, and I have no further trouble on that score.

It is a very hard matter to determine just what tension is safe to use in pulling in the conductors, but to be safe I used two-thirds as stated. This you will note will do away with the block and tackle on branch circuits. It used to be quite a job for me to go over all the different circuits, to see if they had more elbows than necessary on a run of conduit. This is now all done away with by the above clause in the specifications.

G. E. PAINTER.
Baltimore, Md., February 10, 1912.

It is estimated that 500,000 electric meters will be required during the present year for new installations.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Prevention of Condensation on Switchboards.

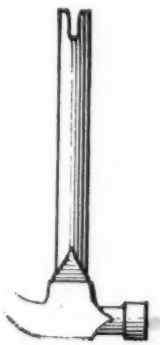
A slate panel in a dairy building was placed in a room where there is a great deal of steam from heating wash water. In very cold weather this caused the panel to be covered with moisture, and at times it was so bad that short-circuits were common and fuses blown. Conditions would not permit putting the panel elsewhere; so it was thoroughly cleaned and dried and then all the exposed copper was coated with paraffin. This was done by melting the wax and applying it with a paint brush. The trouble was thus entirely remedied.

E. D. Stanton.

Tool for Taking up Slack in Knob and Cleat Wiring.

I cut a slot in the end of the handle of my hammer about an inch and a half deep and about three-eighths of an inch wide, as shown in the accompanying figure. When taking up the slack on knob and tube or cleat wiring, I put the wire which is to be drawn tight in this slot about an inch from the knob or cleat just before the screw is tight and give the hammer a half-turn. Thus the wire is drawn against a joist or the side of the cleat and held absolutely tight without the slightest danger of injury to the insulation of the wires.

R. E. Dutcher.



Hammer Slotted for Taking Up Slack.

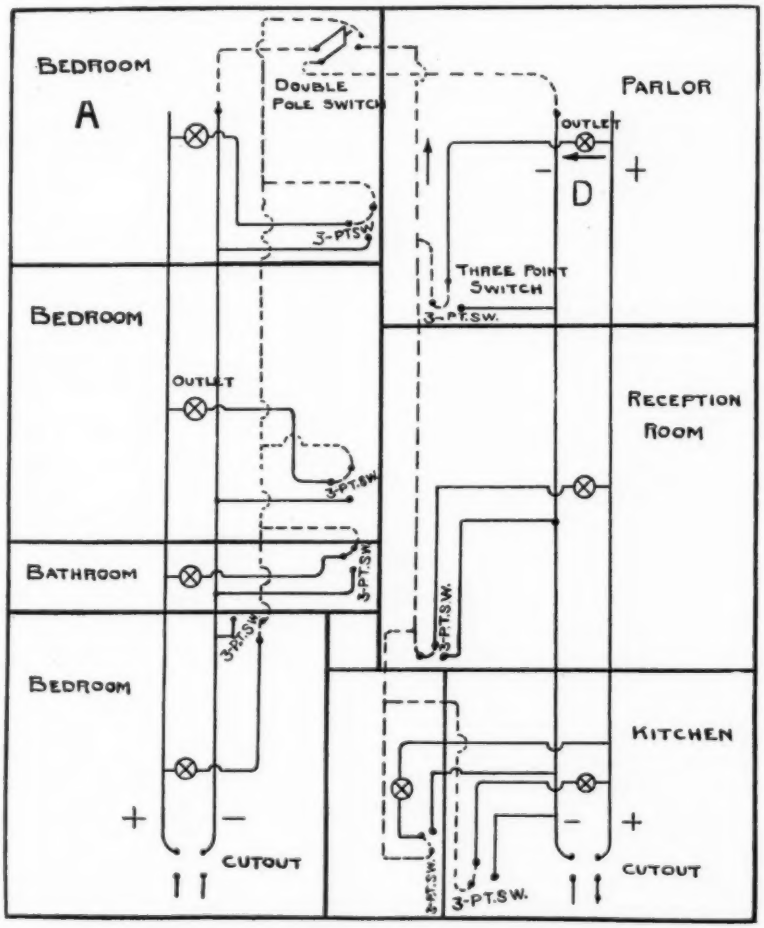
Is There a Better Way?

In wiring a residence a short time ago the writer was requested to arrange the circuits so that the lamps in any room in the house could be controlled by means of a switch in the room itself, and at the same time so that all the lamps on the first floor could be turned on simultaneously by means of a single switch in one of the bedrooms. The desired object was accomplished as indicated in the accompanying diagram, in which the bedroom from which it was desired to control all the lights is indicated by the letter A. Instead of single-pole switches, three-point switches were used and a double-pole switch was installed in this bedroom. In addition to the regular wiring, the circuits indicated by the dotted lines were installed.

How the scheme works will appear from a brief consideration of the diagram. As the diagram is drawn no lamps are burning. Consider outlet D, shown in the upper right-hand corner of the figure, for example. When the double-pole switch in bedroom A is closed the current flows through the lamps installed in this outlet, as indicated by the arrow, to the three-point switch and thence through the lower blade of the double-pole switch and back to the other side of the line. The process is exactly the same for all the other outlets.

I should like to ask if other wiremen know of a better way of accomplishing this sort of control without violating the requirements of the National Code?

George A. Bishop.



Wiring Residence for Control from Bedroom.

Remote Control of Incandescent Lamps.

In installing a master switch for emergency control of lights in a large residence containing fifteen circuits, I encountered two conditions not mentioned in the system of control published in the issue of January 27.

Two circuits were required for the emergency lights. I used a double-pole switch for the master switch, and run one side of each circuit to it. The hall lights were on sets of three-point switches; so I substituted a four-point for one three-point in each set. This method of control proved to be entirely satisfactory.

George W. Howard.

Among the Supply Men

A CARD SYSTEM FOR CONTRACTORS' SOLICITORS AND SUPPLY SALESMEN.

By J. Howard Bothwell.

The contractors' solicitor and supplymen's salesman in making estimates for electrical requirements of any nature should be supplied with information on all electrical apparatus and materials handled by his firm, or he will find himself stumped many times and be forced to return to the office for prices on different articles. If, however, he were supplied with data giving him the latest prices and essential information respecting various material he would in many cases be able to land the contract at once, while the party was in the mood for signing the order, instead of making a second call with the possibility of having lost out in the meantime through someone else better informed having made the call.

The best way in my mind to equip solicitors with prices is to use a card system arranged approximately as is shown in the accompanying illustration.

The top line is worded "Purchased From," or some title which shows where goods were purchased and if out of stock how soon delivery could be expected.

On the end of same line is printed "Date" of purchase, showing how long goods have been in stock.

The next lower line could be used to show method of purchase; such as "contract," "quantity" or similar items.

Next we find the heading "Articles," under which is listed name, such as, knobs, tubes, abolites, etc.

Next comes "Number"; then "Size"; these need no explanation.

Next is given "Discount," which states exact discount of purchase.

Then follows "List," under which all prices are given as list.

Next comes actual "Cost" of article, which gives price without figuring by the solicitor.

Next comes "Wholesale," then "Retail" prices, enabling quotations to be given contractors or dealers by wholesale, and other customers by retail.

The last column is marked "Note" leaving space for additional information and a place to check goods that are to be sold, so as to close out that special line or get rid of poor stock.

Of course, it would be mutually understood that all sheets becoming void are returned to the office before destroying, so as to keep the prices confidential. The purchasing agent should see that all new sheets are issued promptly upon noting any change in market.

These sheets can be placed in a pocket-size loose-leaf binder (3 inches x five inches) and will be found very convenient to wiring solicitors, especially, as they enable them to figure the job intelligently on the premises.

PURCHASED-FROM General Electric Co DATE 1/22-1912

10 Barrel quantity- 3 months delivery F.O.B. factory

ARTICLES	NO.	SIZE	DIST	LIST	COST	WHOLE SALE	RETAIL	NOTE
Knobs.	55		80%	41 50	14 10	19 20	24 00	

Price Card for Solicitors.

Supply Men and Their Interests.

The Metropolitan Electrical Supply Company has been organized to do a wholesale and retail jobbing business at 436 West Broadway, New York City. The firm consists of Charles G. Robinowitch, who was connected for four years with the E. H. Freeman Electric Company, Trenton, N. J., and Leon Portnow, who has been with the Independent Electrical Supply Company, New York City, for about the same time.

Electrical men and supply men particularly, the country over, will be grieved to learn of the death of Joseph R. Lehmer of Omaha, Neb. Mr. Lehmer had been ill for some time, but during the last couple of months his close friends and relatives expected that he would recover and be vouchsafed a great many more years of activity. However, the death of his mother on Wednesday afternoon of last week proved so great a shock that Mr. Lehmer was stricken with heart disease on Saturday morning, February 10, while dressing to attend his mother's funeral. Mr. Lehmer went to Omaha at the age of three years. He was born in Pennsylvania, but all his schooling and practically the best part of his life was spent in Omaha. He had been in the electrical business there for a number of years and was a brother of Frank Lehmer, who died about a year ago. He was 58 years of age and is survived by his wife. Funeral services were held on the afternoon of Sunday, February 11, the Rev. Edward A. Jenks officiating. He was buried in Prospect Hill Cemetery. The pallbearers were Frederick H. Davis, Edward P. Peck, Charles P. Deuel, William A. Redick, Julius S. Sharp and Robert W. Patrick.

The Central Electric Company, Chicago, Ill., held its sales meeting during the week of January 29 to February 3. The meeting was unusually successful and established a notable record with regard to absolute value and satisfaction to the representatives and the house alike. The Central Electric Company celebrates its twenty-fifth birthday this year and no organization

exhibits a greater amount of co-operation and team work. On Monday night, January 29, about seventy representatives of the sales department attended the annual "get together" dinner. The atmosphere was literally charged with good fellowship and there was the usual interpolating of songs and speeches. While sales meetings are generally considered a dull grind of routine, no trace of this is noticeable in the Central Electric Company's sales conventions. The representatives show a live interest in every phase of the matter presented to them. The team work and good service during 1911 were chiefly responsible for the satisfactory return the house enjoyed. A higher mark has been set for 1912 and every one feels that it will be reached. So fortunate is the spirit predominating in the Central Electric organization that it is achieving steadily this result by working together as one man for one end—for the success of the company, and not the success of any individual.

Public Service Commissions

WISCONSIN.

At the request of the City of Marshfield, the Commission has investigated the affairs of the Marshfield municipal water and electric plant and the rate situation now existing and has recommended a new schedule of rates for both departments. After a careful analysis of the records, the Commission found that the conditions which are so common in the majority of municipal plants existed also in Marshfield. That is, through an erroneous method of accounting, the net revenues for the two departments gave the wrong impression as to the equitableness of the two-rate schedules. After properly charging each department with its rightful share of the total expenses, the revenues from the water service were found to be insufficient to meet the cost of service, and the revenues from the electric department were found to return a considerable surplus. In estimating the total cost of service, the Commission computed interest at six per cent and depreciation at one per cent for the water and 4.5 per cent for the electric departments. Although the Marshfield plant is a municipal plant and is not directly taxed, the Commission followed the same policy as in the case of a private plant and included an allowance for taxes in the gross operating revenues. The Commission takes the view that if such items as fixed charges are not considered by municipal plants in fixing rates for private consumers, it would appear that these consumers would be favored as against the taxpayers. In order that each department should bear its proper share of the expenses the water rates were increased and the electric rates decreased.

The rate for electric lighting consisted of a meter rate of 12 cents per kilowatt-hour with a graduated scale of discounts. The following rates were recommended: 10.5 cents net for the first 30 hours' use per month of the active connected load; 6 cents net for the next 60 hours' use of the active connected load; excess rate, 4 cents; In Class A, consisting of residences, 60 per cent of the connected load up to 500 watts and one-third of the excess is to be considered active; in Class B, consisting of stores, offices, saloons, banks, etc., 70 per cent of the connected load up to 2,500 watts and 40 per cent of the excess is o be considered as active; in Class C, consisting of churches, hotels, etc., and Class D, consisting of public buildings, 50 per cent of the connected load is to be active; Class E, signs, etc., all is to be active. The rate for street lighting was reduced to $55.00 per year, per 6.6-ampere arc. Under this schedule of rates the monthly bills of those consumers in Classes A and B will be materially reduced, for it was the residence consumer who, heretofore, has contributed the most to the surplus earnings of the electric department. No change was suggested in the power rates, since the revenues now secured from this class of business appear to be very close to the determined cost of service.

As a result of the recent decision of the Supreme Court in which the water-power law, passed by the last Legislature, was declared unconstitutional, the Commission will not have jurisdiction in the matter of control and regulation of the States' water powers. It was the intention of the law to place all water powers under State control and to refer all matters relating to the cost, use and development of water powers to the Commission for decision. In the opinion, the court declared that the effect of the law would be to take property, which is in fact private, for a purpose declared to be public, without rendering any compensation therefor and to appropriate the private-property rights of riparian proprietors, owning the banks of navigable rivers, in a manner not warranted by fundamental law.

NEW YORK.

The secretary's report to the Commission shows that during the month of January, 1912, 39,957 gas meters were tested, of which 29,952 were repaired and removed meters, 9,507 new meters and 498 meters tested on complaint. Of the meters tested on complaint, 43.8 per cent were found to be more than two per cent fast, 10.0 per cent were more than two per cent slow, and 46.2 per cent were within the limits of tolerance. During the month 64 electric meters were tested on complaint, of which 12.5 per cent were found to be more than four per cent fast, none four per cent slow, and 87.5 per cent within the limits of tolerance.

The Postal Telegraph-Cable Company has again complained to the Public Service Commission, Second District, in relation to the charge made by the Western Union in the receiving and transmission to destination of telegrams handed over to the Western Union by the Postal for points not reached by the latter company. On January 15, the Commission made an order requiring the Western Union to discontinue the practice of charging for the date, the name of the State and the city where the message originated. Immediately after the making of this order, the Western Union promulgated a new rule for New York State alone by which an extra charge should be made for the three words added at the point of transfer, and that is the rule and practice now in force by the Western Union in New York State alone. The three words charged for are "via" and the name of the place and State, at which the transfer of message is made. The Postal Company asserts that it is unreasonable for the Western Union to charge for the transmission of even two words,

those being added by the telegraph company itself merely for its own purpose and convenience and for the purpose of identifying messages and keeping track of the same in its accounts and books, and says that any additional words should not be charged for any more than the address, date, signature and other words added by telegraph companies to messages for safety and convenience in the business are charged for, the same being transmitted free by all telegraph companies, these words so added to the messages and transferred free by telegraph companies being on the average fourteen in number.

MASSACHUSETTS.

An instance of the increasing competition of gas with electric supply in small towns and sparsely settled districts appears in the application of the Old Colony Gas Company for authority to issue $288,000 stock and $192,000 bonds, to complete the construction of its gas plant and high-pressure distributing system. This system has recently been constructed and put into operation for the supply of gas in the towns of Braintree, Weymouth, Rockland, Abington and Whitman, and the price is understood to be $1.00 per 1,000 cubic feet. To reach consumers in these towns, all of which have a scattered population, the company has laid 289,071 feet of high-pressure gas mains ranging from 1.5 to 8 inches in diameter. This 55 miles of gas mains is reported at a value of $274,620 among total assets of $525,000. These figures for 55 miles of mains to reach the very moderate population of all the towns mentioned, together with the fact that the mains represent more than one-half of the total corporate assets, point at once to the weakness of high-pressure gas supply when compared with electric, that weakness being of course the relatively high investment that must be made in gas mains to reach scattered consumers.

VERMONT.

The hearing assigned for January 17, on complaint of Attorney General Sargent vs. Western Telephone and Telegraph Company, as to rates and service, has been continued to a later date.

There will be a hearing at Rutland on March 14 regarding the petition of the Clarendon Power Company for permission to increase its stock and to issue bonds.

The St. Johnsbury Electric Company, in compliance with the order of the Commission authorizing it to increase its capital stock in the sum of $25,000, has filed its sworn returns showing that the entire amount of stock has been issued, and the amount realized thereon is $25,000; and giving in detail the application of the proceeds, which has all been paid out in cash for the extension of an electric line to Danville and Concord and for the erection of a new power plant in the village of St. Johnsbury.

MARYLAND.

A movement is on foot to have the Public Service Commission investigated by the Maryland Legislature, now in session. A resolution calling for the investigation was introduced by Delegate Farmer of Baltimore and it is likely to pass. The Commission, which has been established for only eighteen months, is anxious for any investigation the Legislature may see fit to make. Mr. Farmer is chairman of the Baltimore delegation in the House, and is regarded as one of the representatives of the democratic organization of Baltimore. In an interview he stated that in his opinion the Commission had not done any thing worth while since its organization, and that he is in favor of correcting the situation even if the Commission has to be abolished in order to do it. He maintains that the Commission has not given the people any relief from the exactions of the public-service corporations, that it has not reduced the price of gas or electricity, has given no relief from the overcrowding of cars on the lines of the United Railways, and in re-arranging the rates it gave the Chesapeake and Potomac Telephone Company everything it asked for.

The Commission has now under consideration the matter of the rates charged for gas and electricity in Baltimore, and has been working on the problem for months. No such exhaustive examination of any Maryland corporation's affairs has ever been made as is being made by the Commission into those of the Consolidated Gas, Electric Light and Power Company; it is investigating the street-car lines and in the schedule of rates it recently ordered the Chesapeake and Potomac Telephone Company to put into effect, it made a number of important reductions. It is a fact, however, that the public is not satisfied with the schedule.

Mr. Farmer is an employee of the Pennsylvania Railroad and it is significant that the first appeal from a decision of the Commission was taken last week by that company. Two months ago the Commission handed down a decision in what is known as the Nicholson Branch case. It seems that the Philadelphia, Baltimore and Washington Railroad, a branch of the Pennsylvania Lines, leased from the Delaware Railroad certain lines in Kent County, Md., among which was the Nicholson Branch, a line about three miles long. This line had been allowed to fall to ruin and had been to all intents and purposes, abandoned. Farmers in the county who had been accustomed to use the road appealed to the Public Service Commission to compel the company to put the road in operation and repair it. The Commission held that the road would have to be rebuilt; that public-service corporations could not abandon their properties and franchises at will, and the fact that a certain piece of road, or a branch line, was not profitable was not a sufficient reason for ceasing to operate it. Some time later an application for a rehearing of the case was filed but this had not been acted upon when the company applied in the Baltimore courts for an injunction to restrain the Commission from carrying out its order requiring the company to rebuild the road, and asking that the merits of the case be heard in court.

The second appeal from a decision of the Commission came a few days later when the Western Union Telegraph Company filed a suit in Circuit Court No. 2, of Baltimore, asking the court to declare void the order of the Commission requiring it to establish and maintain an office in the Belvidere Hotel, and to enjoin the Commission from attempting to enforce its order. The company had previously had an office in the hotel but because of some differences with the management withdrew. The hotel company applied to the Commission for an order requiring the office to be reestablished and offering quarters which the officials of the telegraph company admitted were satisfactory.

The Commission held that the public convenience required the establishment of an office in the hotel and, on January 10, ordered the company to establish one there, forthwith, and to maintain it. The telegraph company alleges that the effect of the order will be to compel it to furnish the hotel a special and discriminatory service as a business enterprise, different from that furnished the general public. The Commission, it is asserted, has no right to compel the telegraph company to rent an office from a landlord selected by it in the interest of the landlord's business. It is also alleged that the order of the Commission is void in that it is in violation of the Interstate Commerce Act.

Both these cases raise interesting points as to how far-reaching the Commission's power actually is. It is largely to test the Commission's power that the telegraph company's suit has been instituted, it is said, because the office of the company in the Belvidere Hotel has always been a profitable one.

The Consolidated Gas, Electric Light and Power Company filed with the Public Service Commission its answer to the complaint of Victor G. Bloede, president of the Patapsco Electric and

Manufacturing Company, to the effect that the Consolidated was charging, through its subsidiary companies, less prices for arc and incandescent lamps in territory served by the Patapsco Company than it was charging other parts of the county in which it had no competition. The Baltimore County Electric Company was mentioned as one of these subsidiary companies. The low prices, it was charged, were for the purpose of driving the Patapsco Company out of business. The Consolidated replied that the section of Baltimore County in which a $57 rate is given for arc lamps, is served by the Baltimore County Water and Electric Company. The Consolidated has no control either directly or indirectly over that company, neither has it over the Baltimore County Electric Company. The low prices named were made by contract five years ago and the contract will not expire until June next. Mr. Bloede, it is stated, was a bidder for the contract five years ago, and the facts must be well known to him. The only contract for arc lighting in Baltimore County in which the Consolidated is interested is a contract entered into in March of 1909 for five years at $99.92 per lamp. The statement is also made that the average rates charged for service by the Patapsco Company for the last fiscal year, as shown in its reports, was 9.3 cents per kilowatt-hour. The operating expenses of the company were 9 cents per kilowatt-hour. The price of $57 per arc lamp per year is equivalent to a price of 3.6 cents per kilowatt-hour. The report of the Consolidated to the board shows that the average rate charged by it for service was 3.7 cents per kilowatt-hour.

NEW JERSEY.

The applications of the Eastern Telephone & Telegraph Company and of the Interstate Telephone & Telegraph Company of New Jersey to issue collateral-trust notes and bonds have been denied. The object of both corporations in issuing new securities was to get control of the Continental Telephone & Telegraph Company. In declining to authorize new issues of securities the Commission states that it is not satisfied that the proposed issues are to be made in accordance with law or for lawful purposes.

OHIO.

In a petition filed this week the approval of the Public Service Commission of Ohio is requested for the consolidation of the Central Union Company of Kenton with the Kenton Telephone Company. The latter purchased the former for $4,000, and will dismantle the Bell Exchange. The Bell Company had but 194 subscribers listed. The purchaser also asks permission to issue $22,400 in common stock for the purpose of paying old debts and making good the purchase price.

THE CHOICE OF REFLECTOR.

Discussion of a Paper by Messrs. Sweet and Doane Before the Illuminating Engineering Society.

A meeting of the New York Section of the Illuminating Engineering Society was held in New York City on the evening of February 8, with Chairman George H. Stickney presiding. He called attention to the new provision in the constitution which requires that each section shall have five managers instead of but two, as formerly. H. T. Owens then placed in nomination as the additional managers Clarence L. Law, E. H. Harman and Thomas Scofield. These were elected by acclamation.

The main topic of the evening was the presentation and discussion of a paper by Arthur J. Sweet and L. C. Doane, entitled "The Choice of Reflector—Its Influence upon Illumination Efficiency and Depression in Visual Function." The paper was presented by Mr. Sweet. This paper is a very exhaustive one, giving the results of an extended research conducted in the laboratories of the Holophane Company, at Newark, Ohio.

The authors pointed out first that different considerations should govern in the choice of reflectors for different classes of service. Respecting the influence of illumination upon eye-strain, the chief measures of this are the immediate ocular discomfort and the depression in visual function which the illumination produces. The latter depends upon the intrinsic brilliancy of the light-giving or the light-reflecting objects in the field of view, and upon the contrast in brilliancy which these objects make with their background. The authors expressed the view that depression in visual function is the most conclusive evidence that any illumination conditions are likely to produce eye-strain. Therefore, they made it an important basis of their investigation. After classifying reflectors into fourteen groups and discussing the relative grounds for these classifications, the matter of conducting the tests was described. The object of the investigation was twofold; to obtain highly accurate data on the comparative illumination efficiencies and to compare the main classes of reflectors as to their influence in causing depression in visual function.

The tests were made in an office 13.5 by 23.5 feet, and 10 feet, 4 inches high. The wall and ceiling surfaces were covered with white matt cardboard, and then in some tests this surface was covered with black flannel cloth. This enabled tests to be made with white walls and white ceiling, white walls and black ceiling, black walls and white ceiling, and black walls and black ceiling. Two types of installation were made. In one, 40-watt lamps were distributed over the entire ceiling so as to produce a total of 1,914 lumens. In the other, two units were employed, a 100-watt lamp in the small bay and a 150-watt lamp in the larger bay, producing a total of 2,075 lumens and typifying the center-of-room type of arrangement. The tests were carried on for several months, and a large number of constants and very valuable data obtained.

The second part of the investigation, that showing how the choice of reflector is influenced by depression in visual function, was made with only four classes of reflector, for the sake of simplicity. The test object was a solid circle flanked on either side by a solid black square, or the reverse. The subject was required to tell whether the central of the three objects was a circle or square. This involved the necessity of being able to see clearly the contrast between the object and background. The test method is based on the assumption that the efficiency of the eye in the dark is 100 per cent. With the eye in the dark, the object is illuminated to the intensity required to just produce visibility. Then with the eye exposed to the illumination conditions being studied, the object is again illuminated to the point just producing visibility. The intensity of illumination in each case is measured. By dividing the former illumination by the second, a value is obtained which the authors believe to represent the efficiency of the eye. They gave many arguments to verify the accuracy of this contrasting method of testing visual depression, and assert that its results are applicable to illumination conditions in general. All light entering the eye tends to cause depression in the visual function. The degree of depression depends upon the total amount of light entering the eye and upon the angle with the line of vision which each portion of such light makes. It does not depend upon the intrinsic brilliancy appreciably. Excessive depression is therefore avoided by eliminating all light in the eye in excess of that actually required for purposes of adequate vision.

The four systems tested on this basis were: prismatic focusing reflectors—with the distributing arrangement, aluminumized metal intensive reflectors with distributed arrangement, light-density opal reflectors, with distributed arrangement, and indirect mirrored reflectors with center-of-room arrangement.

The principal general conclusions of the authors are as follows: 1. From

the standpoint of illumination efficiency, the correct type of prismatic reflector is considerably more satisfactory than any other type of lighting unit. If the correct type of prismatic reflector is not chosen, the results are about equal to those given by other types of reflectors. 2. Light-density opal glass is not a suitable material for reflectors, except, possibly, for types of service where esthetic consideration strongly outweighs considerations of illumination. Such reflectors should never be used in illuminating interiors, having walls of a high co-efficient of reflection, where long-continued, close visual work is frequently performed. 3. Dark walls exercise a much less influence in cutting down the efficiency of illumination than has been previously supposed. 4. Where wall co-efficients are low, relative depression in visual function affords no highly important reason for choosing one type of reflector over another. However, if long-continued, close visual work is to be performed under the lighting installation, it will be wiser to choose the type of unit giving minimum depression in visual function, even when wall co-efficients are low. If the latter are high, it is of considerable importance to select units giving minimum depression in visual function, especially for service where long-continued, close work is to be performed. 5. The relative influence of different types of lighting unit in causing depression in visual function may correctly be judged by the relative light flux within, approximately, the angles of 50 and 80 degrees with the vertical. The flux emitted by the light unit in the 60 to 70-degree zone is especially fruitful in causing depression in visual function. 6. Walls, up to the height normally coming within the field of vision, should have as low co-efficients of reflection as is consistent with the avoidance of gloomy and depressing effects.

The discussion of the paper was opened by E. L. Elliott. After commending the scope and thoroughness of the authors' work, he regretted that they had included under the class of opal reflectors the type of glass known in the trade as Alba, which is of a distinctively different character. One general conclusion of the paper is that we have best vision when we have the greatest diffusion in the sense of having the light come from the most directions. The reason that daylight is so much better than artificial light is entirely due to its better diffusion. In conclusion, Mr. Elliott agreed with the statement that we get better vision with dark walls.

Preston S. Millar disagreed with the authors in making their conclusions too broad and general, particularly in their condemnation of the use of light opal glass for reflector purposes. He did not feel certain that the conclusions obtained from these tests made with the extremely low illumination intensities employed would be justified under normal conditions. He thought that the light opal glass throws scarcely any more light upon the wall than does prismatic glass.

H. E. Ives stated that he also felt that the conclusions at the end of the paper were too broad and involved considerations that were far from being proved. For instance, the inference to be drawn from the last conclusion that light walls are bad, is by no means proven. He disagreed with the assumption that the ideal condition for the eye is complete darkness. At very low illumination the efficiency of the eye as an aid to locomotion and vision is very much decreased. Therefore he thought that Mr. Sweet has measured the wrong thing. Moreover, in physiological and psychological work one cannot argue the results of one condition to those of another. More variations of the lighting arrangements should be considered, because in nature these are extremely varied.

J. A. Clark agreed with Mr. Elliott in condemning the classification of Alba with light opal glass. The authors' conclusions also are entirely unjustified. Actual tests of installations have shown that light opal reflectors have given results almost as good as prismatic reflectors. The type of semi-indirect lighting fixture that was tested was not typical of the best that may be done in this line.

W. M. Skiff said that some exhaustive tests are now under way in Cleveland, whose aim is to supply reliable data as to the rapidity of deterioration which characterizes different types of units.

Norman Macbeth ridiculed the assumption that illumination efficiency must take account of horizontal illumination only. He argued this point with Mr. Sweet at some length, and then also criticised the authors for condemning light opal reflectors and failing to condemn the patent-finished prismatic extensive reflectors.

S. W. Ashe referred to some tests that had been made in his laboratory along somewhat similar lines. These had been conducted for a period of some four years and proved that, as far as fatigue is concerned, there is practically no difference from direct or indirect lighting if normal intensity is used. Others who discussed the subject were R. F. Pierce, S. L. E. Rose, H. Thurston Owens, and W. R. Moulton.

Mr. Sweet closed the discussion by objecting to those criticisms of the paper that were not verified by definite arguments or data. He felt that only one of the criticisms that had been made deserved consideration, and that was the one made by Dr. Ives whether tests made at very low intensities will apply at higher intensities. This matter is open to a possible question, but the authors had carefully considered it and felt justified in basing their conclusions on the tests as conducted. Respecting the classification of light opal glass he felt that the distribution results obtained with it are the basis of the classification that he had made and he had not done it from a spirit of commercialism. If that had been his motive he could have gone to much further extremes.

Public Assignment of Patents for Electrical Fittings.

An assignment has been made to the public by Frederick A. Swan of the Swan Electric Company, of a number of patents taken out since January 1, 1908, upon electrical fittings, as well as upon a number of applications now pending.

The patents involved are the following:

No. 877,383. Means for securing cords to lamp sockets.

No. 877,384. Electrical fittings.

No. 897,674. Terminals for electric fittings.

No. 935,705. Strain-relieving means for terminals of lamp sockets, rosettes and other electrical fittings.

No. 962,063. Strain relief for lamp socket.

No. 967,997. Electrical fittings.

The following applications are still pending:

No. 476,213. Strain relief for electrical fittings.

No. 497,482. Rosettes.

No. 521,814. Pendent lamp socket.

No. 580,725. Cord adjuster.

No. 595,605. Rosettes.

Large Swedish Development.

The Swedish Government has begun a new power installation which bids fair to rival the Trollhättan works. It will utilize the water power of the Lule, which falls into the Gulf of Bothnia at Lulea. The minimum power available is 70,000 horsepower, and by means of reservoirs a turbine horsepower of 300,000 can be made available at any season of the year.

New Telegraph Lines in Guatemala.

An executive decree of November 11, 1911, provides for the construction of a telegraph line between Tenedores and the Barra del Motagua, the cost of the same to be paid from the receipts of the Puerto Barrios custom house.

National Independent Telephone Association.

Annual Convention, Chicago, February 7, 8 and 9.

The fifteenth annual convention of the National Independent Telephone Association was held at the Hotel Sherman, Chicago, on February 7, 8 and 9. The convention was marked by the frank interchange of opinions. Although the number of papers was not great, they freely reviewed the situation in the telephone business and all urged that a more cordial spirit of co-operation should prevail. Though only a limited time was given to technical discussions, these were more general than heretofore. As usual, the exhibits made by telephone manufacturers and supply dealers were very complete and attracted much attention, many new telephone devices being shown.

The first session of the convention was opened shortly before Wednesday noon with President Manford Savage in the chair. H. J. Friedman, of the city corporation counsel's office, was sent by Mayor Harrison to welcome the members to Chicago. J. W. Barnes, of Fairmount, W. Va., responded on behalf of the association, pointing out that the independent movement in telephony was distinctively a people's movement that has come to stay.

President Savage made "The Outlook" the subject of the annual presidential address, in which he reviewed the past, analyzed the present and made recommendations for the future of the independent telephone movement. Formerly self-interest largely dominated it, especially on the part of financial backers and promoters. The latter are losing control and retiring from the business. The outlook for the telephone business was never better than today. An era is at hand when intelligent co-operation under some form of government supervision will take the place of destructive competition and give adequate returns and permanent security to the business as well as full protection to the public.

Government regulation is here to stay — independent telephone men should help bring it about and see that it is fair and not discriminatory. Public-utility laws should be urged and active interest taken in making them rational. It must be remembered that no legislation approaching confiscation has stood the test of the courts and the promotion of a law that is too drastic will hurt the promoters. The power of the law to suppress monopoly and restore competition may be extended also to suppress the evils growing out of unrestricted competition. The object in invoking the law against a competitor is to make him cease unfair competition. If that result can be secured by business negotiations, it is well to go a little slow in appealing to courts or legislation since the latter may go too far. Constructive legislation is needed instead of indiscriminate attacks upon capital.

There is no call for government ownership of utilities, if we have properly regulated and controlled public-service corporations. The public must be protected by compelling all utilities to submit to a fair form of governmental regulation with power to prevent discrimination and unfair competition and having supervision over rates and character of service. A broader and more business-like attitude is needed on the part of the independents. On the other hand, the impractical dream of a universal monopoly of wire communication must be abandoned. In any case, readjustment to prevailing conditions is needed and it is fortunate that a more conciliatory spirit is now manifest.

Mr. Savage called attention to the co-operation by the association with the Interstate Commerce Commission in developing a uniform system of accounting for interstate companies. Recognition of the independent movement has been accorded not only by the Government but by the competing interests. However, the independents must be more charitable to each other and recognize the varying influences of different local conditions.

N. G. Hunter, of Wabash, Ind., moved a vote of confidence in the president and of concurrence in his address. Mr. Savage called attention to the new by-laws of the Association and appointed the following committees: Nominating Committee — Messrs. Fisher, Mattison, Hunter, Gary and Herrick. Committee on Resolutions—Messrs. Godard, Cable and Hunter. Credentials Committee —Messrs. Schade, Vivian, Robinson, Adams and Bryant.

Commission Control in Wisconsin and Ohio.

On Thursday morning the session was opened by the reading of a paper entitled "Experiences Under Commission Control," by J. C. Crowley, of Superior, Wis. He said that in Wisconsin the public utilities were at first reluctant to come under the control of the broadened jurisdiction of the Wisconsin Railroad Commission in accordance with the public-utility act. After several years with commission control the utilities would not now go back to the old regime. The personnel of the Commission has always been of the highest and its rules and decisions eminently fair to both the public and utility companies. Operating under such a public-utility law the investor feels more secure, the company is in a better position to demand an increase in rates when necessity demands it, and the public becomes better satisfied when it understands that the capital invested in the plant is a fair and just one and the management is economical and efficient, giving good service at a minimum cost consistent with a fair return on the investment. Under such a commission the subscriber realizes that there is no discrimination between him and his more influential neighbor. He also knows that, if the service he is receiving is not what it should be, he can obtain redress through the commission. He knows that he must pay his bills promptly or the company will be required by the commission to discontinue his service.

Free telephones have been eliminated and a fixed schedule of rates established. The companies formerly did not know the actual cost of the service nor the trade value of their plants. The system of accounting now established has disclosed these figures. Definite rules have been made for collections. In short, Mr. Crowley strongly advised following the Wisconsin law in the organization of other state commissions. He concluded with a brief review of the situation regarding physical connection of different telephone systems. The law enacted on this subject has not yet been put into execution.

A brief discussion ensued regarding the compulsory payment of bills. Frank H. Woods, of Lincoln, Neb., said the Nebraska Commission requires this.

S. E. Ward, of Mansfield, O., then talked at some length on "The Ohio Situation." In that state the independent companies have developed their systems to about 350,000 telephones, despite ruinous competition in many quarters. The Bell interests frequently bought up important links in the independent system. One day

it was found that all the long-distance lines had been sold to the Morgan interests. It turned out, however, that these, as well as the independents, took a sane co-operative view. Moreover, it was found that many men who had been outcast because of entangling Bell alliances were sincere and live telephone men with the best interests of the industry at heart. As a result, a spirit of co-operation took hold of all the telephone interests in Ohio. A state-wide agitation for public utility control resulted in the passage of a utility law which is enforced by a commission that assumed control last July.

This law prevents the giving of service at rates below cost. It permits the consolidation of competing utility companies under commission supervision. This was because the people of Ohio were convinced that no two competing telephone companies can permanently continue to exist in the same territory and make money. Such is a useless waste of efforts. As soon as mergers were permitted, they were undertaken, the stronger company in each case buying up the weaker one. In all these deals the local stock holders were favored. Practically every independent company in Ohio has taken steps to either connect with, buy up or sell to the Bell interests in its district, always under fair commission supervision and control. The aim is to give each telephone subscriber the opportunity to get universal service at reasonable rates. About three-fourths of the Ohio counties will be controlled by independent telephone companies whose lines will connect with long-distance lines in every direction. At each step of the negotiations the independent telephone men have been satisfied; they found the Bell interests fair and reasonable. The negotiations were not compulsory with the independent men, but entire voluntary, since they realized that the growth of the business would ultimately demand the abolition of ruinous competition and the granting of universal service.

B. C. Hubbell, of Buffafo, N. Y., brought up the subject of mutual fire insurance and pointed out the value of placing insurance with any mutual company that pays the full value of its policy instead of only the supposed depreciated value of the property destroyed.

At this point the Nominating Committee reported a list of 35 names from among whom, or additional names, 17 directors of the Association were to be elected by Australian ballot. Directly after the acceptance of the report a dispute arose as to whether the disqualification clause, which made a member who had made any alliances or negotiations with the Bell interests persona non grata, should be strictly observed. A prolonged and bitter discussion of internal politics ensued with many personalities and side issues. The outcome was that the report was recommitted back to the committee for further deliberation.

The report of the Committee on Credentials was presented and adopted. A recess of an hour and a half was then taken.

On the re-assembling of the convention, Chairman Fisher of the Nominating Committee presented its revised report which was the same as the original with the addition of one other name. This report was accepted without further debate as the official ballot. The balloting took place between 5:30 and 11:30 p. m.

Technical Conference.

The convention then resolved itself into a technical and operating conference presided over by L. E. Hurtz, of Lincoln, Neb. This proved to be a valuable interchange of ideas and experiences. The first topic was on economics to be effected in small exchanges, particularly as to life of dry batteries. This was found to vary generally from six months to two years, depending on the amount of service; one man found some cells to last five years. Several replace all the cells free once a year but charge for renewals for depleted cells during the year. One member opens the partly depleted cells, pours in fresh salammoniac solution and uses them for central-energy batteries. The life of dry cells that are left lying down on the side is much less than when standing upright.

Pole preservation was discussed by several speakers. Several used the brush treatment with an apparent gain of five years in the life of the pole. One member used cheap coal tar from a local gas company, although the effectiveness of this method was questioned by other speakers. Crude oil at 50 cents a barrel has also been tried. Carbolineum has been found quite effective, even when but one coat was applied. The pole is placed over a trough and turned while hot carbolineum is poured over it and thoroughly brushed in. The cross-arms and pins are also treated in some cases with good results. A member advised that the butt of the pole and its bottom surface be also treated to prevent moisture being drawn up and rotting the pole inside, as has been found when only a band at the ground line was treated.

Numbering of party-line subscribers to facilitate simple-code ringing was discussed briefly. A common method is to use the first two figures to indicate the line number and the last two to indicate the number of short or long rings. The advantage of providing one-way or so-called "kitchen" service were described by one speaker. The telephones consist merely of transmitters and receivers and are used for outgoing calls from the kitchen only. Such service can be given at very low rates and results in the ultimate conversion of many of these subscribers to regular service.

The privileges of the floor were accorded to several specialty men who gave two-minute talks on recently developed telephone appliances.

On Friday morning the technical conference was resumed with a discussion of the use of automobiles in trouble work. One speaker said from experience he found that a gasoline motor wagon gave much speedier service and the cost per mile was only about half that with a horse-drawn wagon. A light pneumatic-tired runabout was best suited for rough country roads. After proper instruction the regular lineman can take pretty fair care of an automobile. Use of a machine is justified if enough service for it can be found to keep it busy. Several companies prefer motorcycles rather than automobiles; others use both. The chief advantage in each case is in the time required to get to the source of trouble, another is the reduction in number of men needed.

Phantom circuits formed the final topic in the technical discussions. It is almost criminal to overlook the possibilities in this line. The phantoms are the best circuits. In order to transpose properly, the physical circuits must be adjoining.

The Telephone Situation.

On the adjournment of the technical conference, the final convention session was begun at 11:30 a. m., with an address on "The Situation" by A. A. Godard, of Topeka, Kans. He stated that the telephone situation has for some time been a very changeable one. The feeling is now becoming strong that the relation of telephone companies must be a friendly one and as close as possible in order to properly promote the business. The conditions must be grasped as they are found. The independent telephone movement by its earnestness and perseverance has compelled recognition from the Bell interests and caused them at last to change front.

The great competitive telephone centers are gradually being wiped out, either the independent or Bell interests buying up their competitors. In

no place where there are two opposing telephone companies are both of them making any money, and in many both are losing money. Most of the membership of the Association represents the 25,000 independent telephone exchanges that have no competition. This class has not had sufficient sympathy for those companies that have to meet sharp competition; the latter companies are only one-fifth of all the independent companies.

Local exchange and toll business are closely related. Lack of co-operation between them is detrimental to both. The conditions now do not require the former destructive warfare, because so few of the independent companies are on a competitive basis, because public-service commission control is so general and because the opposition interests are more reasonable. Therefore, the Association should devote itself to the development of the telephone business in general; instead of chiefly fighting the competitors. If any independent company can make a satisfactory contract with the Bell interests, it should not hesitate to do so.

General Godard said that there had been too much politics in the Association and not enough of technical discussions. There should also be more discussion of utility regulation, which should be fostered as it will protect the companies from unjust opposition and unfair public prejudice. In conclusion, the speaker made a strong plea for harmony in the Association and loyalty to its interests. The state associations should also be given support, as they are peculiarly adapted for the consideration of local issues.

Messrs. Adams and Neill, as judges of election, made their report on the result of the balloting for directors. The following 17 names were announced as the choice of the Association: E. B. Fisher, representing Michigan; Nelson G. Hunter, Indiana; H. D. Critchfield, Illinois; S. E. Ward, Ohio; Manford Savage, Illinois; H. B. McMeal, Illinois; W. J. Thomas, Kentucky; E. D. Schade, Pennsylvania; J. C. Casler, Texas; B. G. Hubbell, New York; A. A. Godard, Kansas; F. H. Woods, Nebraska; L. D. Kellogg, Illinois; G. W. Robinson, Minnesota; Theodore Gary, Missouri; W. C. Handlan, West Virginia; Richard Valentine, Wisconsin. This board of directors is to elect the officers of the Association for the ensuing year.

D. J. Cable, chairman of the Committee on Resolutions, presented six resolutions that were adopted. These were in brief as follows: For Federal control of interstate telephone business; against Federal control of local telephone business; for state public-service commission control over the local business; commending President Savage's address and policy; resolutions of thanks to *Telephony* and to the Hotel Sherman.

A paper on "The Future of the Telephone," by J. C. Kelsey, was presented by title but not read. On motion of J. C. Casler, the president's address is to be printed for general distribution. The convention then adjourned.

A very pleasant feature of the convention was the banquet held on Thursday evening. Judge Nelson G. Hunter, of Wabash, Ind., acted as toastmaster. The other speakers were C. O. Frisbie, president of the Illinois Tunnel Company, Chicago; W. B. Nesbit, of Chicago; D. M. Neill, of St. Paul, Minn.; President Manford Savage, of Champaign, Ill.; H. H. Johnson, of Cleveland, Ohio; W. L. Visscher, of Chicago.

Telephone Exhibits.

An array of the latest telephone devices was shown by the large number of telephone manufacturers and supply houses represented. Practically all of the second floor of the hotel was engaged for this purpose. Among the exhibits were the following:

H. E. Adams Manufacturing Company, Pittsburgh, Pa. Cable hangers, cable taps, potheads, bonding clamps.

American Electric Company, Chicago. Magneto and common-battery telephones and supplies.

American Steel & Wire Company, Chicago. Telephone line wires and messenger strand.

Automatic Electric Company, Chicago. Full automatic telephone system, including private-branch exchange; automatic traffic distributor for manual exchanges; automatic monitor system; automatic enunciator.

Baird Electric Company, Chicago. Pay stations, time stamps, lockout system for party lines, wire chief's test set.

Frank B. Cook, Chicago. Cable terminals, protective devices of all kinds for distributing frames, toll lines, substations, etc.

Corwin Telephone Manufacturing Company, Chicago. Private-branch exchanges for automatic and manual service.

Cracraft, Leich Electric Company, Genoa, Ill. Magneto telephones and switchboards, harmonic ringing system, common-battery sets.

Dean Electric Company, Elyria, Ohio. Telephones and switchboards, harmonic ringing converter for party lines.

Denio General Electric Company, Rochester, N. Y. Fire-alarm system for manual or automatic telephone equipment.

Electric Appliance Company, Chicago. Telephones, wire, batteries and other supplies.

Electric Specialty Company, Cresco, Ia. Telephone condensers.

Electric Specialty Manufacturing Company, Cedar Rapids, Ia. Wireless cable test set.

Electric Storage Battery Company, Philadelphia, Pa. Storage batteries of all types for telephone exchanges and trouble-wagon service.

Ericsson Manufacturing Company, Buffalo, N. Y. Telephones, switchboards, test sets, specialties.

Everstick Anchor Company, St. Louis, Mo. Everstick guy anchors, boltless pole clamps.

Fibre Conduit Company, Orangeburg, N. Y. Fiber conduit.

Elwood Grissinger, Buffalo, N. Y. Telephone repeater.

Holtzer-Cabot Electric Company, Brookline, Mass. Telephones, ringing machines, frequency vibrator, test sets and other supplies.

Illinois Electric Company, Chicago. Klein linemen's tools, Gray pay stations, interior wire and other supplies.

Indiana Steel & Wire Company, Muncie, Ind. Telephone wire and messenger strand.

Kellogg Switchboard & Supply Company, Chicago. Magneto and common-battery telephones and switchboards, convertible equipment adapted to change from magneto to common-battery service. The company got out a convention daily called "Telephone Facts."

Kripps-Wright Company, Philadelphia, Pa. Aerial cable hangers, messenger-cable car.

W. N. Matthews & Brother, St. Louis, Mo. Guy anchors, Telafault cable test set. O. L. Loudenslager, of Lamars, Ia., won the Telafault set that was donated by this firm.

Minerallac Company, Chicago. Unity telephone insulator and Minerallac insulating compounds.

Monarch Telephone Manufacturing Company, Fort Dodge, Ia. Telephones and switchboards for magneto and common-battery exchanges.

National Carbon Company, Cleveland, Ohio. Dry cells.

National Pole Socket Company, Pittsburgh, Pa. Tubular pole reinforcement.

North Electric Company, Cleveland, Ohio. Automanual telephone equipment, universal board, telechronometer, synchromonic five-party selective-ringing system, automatic message meter.

Nungesser Carbon & Battery Company, Cleveland, Ohio. Dry cells.

Paragon Sellers Company, Chicago. Paragon ground cone, drop wire and other specialties and supplies.

Pyrene Company, of Illinois, Chicago. Pyrene fire extinguisher.

Reliable Electric Company, Chicago. Telephone and switchboard protective devices.

Specialty Device Company, Cincinnati, Ohio. Bierce cable sleeves and cable rollers.

Standard Underground Cable Company, Pittsburgh, Pa. Colonial copper-clad wire, telephone cable.

Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Telephones and switchboards for all kinds of manual service, combination telephones, private and intercommunicating telephone systems, mine telephones, special telephones for the deaf.

Swedish-American Telephone Company, Chicago. Telephones, switchboards and parts.

Warner Electric Company, Muncie, Ind. Pole changers for telephone exchanges.

THE COST OF POWER WITH REFERENCE TO THE LOAD CURVE AND OVERLOAD ECONOMIES.

Monthly Meeting of the American Institute of Electrical Engineers.

The 268th meeting of the American Institute of Electrical Engineers was held in New York City on February 9. President Gano Dunn occupied the chair. The paper of the evening was by George I. Rhodes and was entitled "A Method of Studying Power Costs With Reference to the Load Curve and Overload Economies." An abstract of the paper follows:

The largest item in the cost of power is fuel. Much depends upon the unit cost of fuel and the efficiency of the prime movers and boilers. The thermal efficiency depends largely upon the type of load carried. A fluctuating load requires more fuel than a steady load, and an all-day load with morning and evening peaks requires more fuel than a steady load during a part of the day only. In order to deduce operating economies from test results the author classified the losses involved. In both electrical machinery and heat engines there are three elements of the input which are dependent respectively upon the useful output, upon no-load losses and upon the losses which vary with the load in proportion to the square or some higher power. The dependence of the operating efficiency and of the total input upon these various elements was expressed mathematically and a number of curves given showing the variation of input, of efficiency and of specific consumption upon the value of the variables involved under different specified conditions of operation. The classification of operating costs in accordance with the equations was applied to certain test data and the results given in a table. The effect of power economy at overloads on the cost of power was then discussed and curves given showing the relation of the total cost of power in relation to the average power, the peak power and the rating of the plant. The reduced efficiency at overload makes the cost of power under that condition very large, but it is shown, nevertheless, that there is a reduction in operating cost with a reduction in rating due to the saving in no-load losses. This reduction continues to a point which depends upon local conditions and varies between 60 and 85 per cent when operating costs alone are considered, and between 50 and 70 per cent when fixed charges are included. The author consequently considers it advisable to run a plant at the maximum possible overload during the winter peak, a limit being set only by the capacity of the apparatus, and by the element of insurance, which makes it advisable to have a spare unit. With a plant rated at 60 per cent of the maximum load a turbine must be operated at about 170 per cent of its rating, and a boiler at about 200 per cent. These overloads are not possible with turbines as at present constructed. In the boiler room it is, however, possible to secure greater overloads than called for. A large sacrifice in overload economy may be allowed for the sake of securing overload capacity.

The discussion was opened by H. G. Stott, who referred to some of the items which enter into the cost of power. The simplest of these is the part related to investment and amounting to 12 per cent thereof. Investment is made up of three principal items—real estate, buildings and equipment. As a complication involved, he called attention to the fact that real estate in most places is appreciating in value, though in some places it may be depreciating, as are the other elements. Equipment, if properly kept up, has a very small rate of depreciation, but a high rate of obsolescence, due to progress in the art. This point is exceedingly hard to handle in the accounting. Operating costs are even more complex. The value of coal is proportional to the heat units, but this relation is modified by the presence of ash, which intereferes with the ulitization of the total heat units. The Standardization Committee should define the terms "rating." The rating of steam engines was based on the point of maximum efficiency; with turbines it is usually maximum capacity, leaving a tremendous margin between the two points and making it almost impossible to say just what "overload" means. He did not agree that the largest item in the cost of power was fuel, because with a load-factor as low as 25 per cent the fixed charges would be larger. An important point of the paper was to point out the necessity of keeping down the fixed charges and to show how relatively unimportant were the maintenance and operating charges on overload.

H. L. Smith was skeptical as to whether the use of the mathematics employed by the author would be of any help in the analysis of operating expenses, because where the mathematics involved were not very simple it was hardly possible to assign correct values to the necessary constants. With the steam turbine, where the steam consumption is proportional to the load, the mathematical relation helps in eliminating errors in the data, but where the relation is not linear the mathematical expression is of little help, although if enough terms are added it may be made to fit experimental data.

J. C. Lincoln called attention to the impossibility of putting a 200-per-cent overload upon the apparatus, which is often rated at its maximum capacity. Even with electrical machinery, the normal rating of the older days, which permitted a temperature rise of 35 or 40 degrees, is being abandoned and ratings used which requires a rise of 50 or 55 degrees above the atmosphere. This is equivalent to a reduction in the size of the kilowatt.

C. A. Mailloux emphasized the importance of the author's work, which he considered epoch-making. It was largely due to the electrical engineer that accuracy had been introduced into general engineering, including measurement of power and of boiler operation. The paper was an attempt to correlate the various factors entering into the general problem of economy of operation. He pointed out that the coefficients used in the equations must be obtained graphically from operating results, and that when so obtained the application of the mathematics was a great aid in determining the cost of power under the different conditions of load. He referred to the problem of rating as one of the most important of the day. The International Electrotechnical Commission was considering it. They found that, as a prerequisite, it was necessary to have international understanding upon the meaning of the terms used in the definitions. In the five years since the Commission was organized only the foundation work has been laid, in coming to an understanding as to nomenclature, symbols, etc. It may be several years yet before the ratings of machinery can be defined.

Farley Osgood commended the paper and considered that the excessive overloads referred to had been mentioned merely to bring out clearly the facts set forth in the curves and calculations. He referred to the many items entering into the cost of power and thought that when these individual items had been determined and inserted in the general calculations, the simplicity of the results would emphasize the value of the paper.

Gano Dunn concurred in the remarks of the two previous speakers and expressed the necessity for exact definitions of the terms "cost," "fixed charges," etc., used in the paper, so that application of the formula in the future would be in agreement with the basis upon which it had been worked out.

In closing the discussion, George I. Rhodes spoke of the ignorance now prevalent as to the relative efficiency of different plants. To know whether change of management in the operation of a plant would reduce power costs, it was necessary to have a more complete and better method of analyzing them.

After adjournment of the meeting a smoker was held in the Institute rooms on the upper floor of the Engineering Societies Building.

Jovian Luncheon and Rejuvenation in New York.

Wednesday of last week was a particularly active day among the Jovians of New York City. First, a largely attended luncheon—probably 200 being present—was participated in at the down-town meeting place, being presided over by Statesman F. E. Watts. The speaker of the occasion was Philip S. Dodd, the secretary of the Commercial Section of the National Electric Light Association.

Mr. Dodd outlined briefly the work which had been done and which was being done by the Commercial Section of the National Electric Light Association, mentioning the value of the reports which had been prepared by the Commercial Section committees last year, and the value of the two publications, "Data on Electric Signs" and "The Electrical Equipment of the Home" for the development of the industry along educational lines, and their value as a force in the education of the public concerning things electrical. He explained that the plans of the Commercial Section for the coming year embodied the preparation of at least three other publications along similar lines, which would be prepared for general distribution to assist the central stations and manufacturers in the development of their business. Also that the plans of the Section embodied the compilation and distribution of a "Cumulative Commercial Index and Digest" for the benefit of the commercial men in the industry. The digest to contain a complete catalogue of current consuming devices together with data relative to their various constructions and installations, and abstracts and digests appearing in the technical press. The Section had planned for an Advertising Exchange which would give to its members the best thought in the country pertaining to advertising and developmental campaigns for use of business-getting departments.

Robert L. Jaynes, reigning Jupiter, was called upon. He brought out very forcibly to all Jovians present the tremendous power which could be exerted by a local organization when backed up by a Jovian membership of 5,600 electrical men. Plans are on foot in a great number of the cities throughout the country for a definite organization of local Jovian luncheon clubs, and not only was the membership of the Jovian order developing rapidly to a point where Mr. Jaynes believed and hoped the membership would reach 10,000 before the end of the Jovian year, but that the enthusiasm for Jovianism and its work and the extension of its motto "All Together All The Time For Everything Electrical" would bring the Order nearer and nearer to the ideal on which it had been established, and to a point where national plans would be brought to light for definite, practical co-operative work for the development of the industry and to the individual members.

On Wednesday evening there was a gathering of about 300 Jovians at a dinner held at the Hotel Astor, on which occasion 116 new members were initiated, this number excelling the highest former record, which was 110 members elected at Denver. Statesman F. E. Watts received many congratulations over his success in this respect. The usual, and some unusual, ceremonies entered into the initiation of this large number of Jovians, as was quite fitting on the occasion of such an increase in the membership. A book of songs was left at each diner's plate, with the compliments of the General Electric Company, and some excellent singing was indulged in. A flashlight photograph of the assembly was taken, and is reproduced herewith.

As it stands now, New York City carries the Jovian banner for the greatest number initiated. However, several other cities will no doubt undertake to excel this record.

Among the Jovians present were Rober L. Jaynes, of Pittsburgh; Washington Devereaux, of Philadelphia; Phillip S. Dodd, of Cleveland; Charles H. Hodskinson, of Boston, and M. A. Oberlander, John Dale, B. M. Downs, G. W. Elliott, Charles W. Price, E. E. Wood, Arthur Pope, George L. Patterson, Theodore L. Jones, Richard S. Satterlee, James B. Olsen, Joseph F. Becker, Ray D. Lillibridge, Frank W. Smith.

Luncheon of New York Jovians.

Residence Tariffs.

During the two nights' discussion at the Institution of Electrical Engineers, in London, on the paper by A. Hugh Seabrook on "Residence Tariffs," the telephone system of charging used by the author at Marylebone came in for a good deal of attention. One of the speakers made a suggestion that the Institution should, when it emerges from the present debate regarding its new articles, show its more commercial spirit by appointing a committee to investigate the subject of electric rates. Mr. Seabrook expressed himself in cordial agreement with the suggestion, holding that it might lead to the adoption of a standard system of rates.

New Electrical and Mechanical Appliances

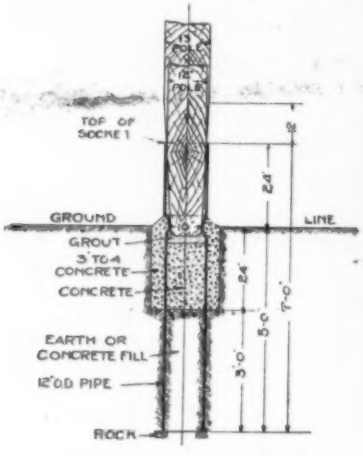
The National Pole Socket.

Electric light, power, and telephone companies, in fact all electrical companies having occasion to use poles for overhead wires are continually confronted with the problem of fighting decay of the poles at the ground line. As the price of lumber is steadily increasing a means of increasing the life of the poles in service is highly desirable.

A method of doing this has been developed in the shape of the National Pole Socket, several illustrations of the use of which are given herewith. This is a seamless steel tube about a quarter of an inch thick and of a total length of about seven feet. It is made in various diameters to fit different sizes of poles. Before shipment a heavy coating of asphaltum is applied to protect the steel tube.

The old pole which has been badly decayed at the ground line is sawed off at this point, and then moved to one side without any interference with the overhead wires. By means of an axe and a draw-knife the butt is slightly tapered to fit inside of the upper end of the socket. Only three men are needed to do the entire work. While one man is shaping the pole, two other men at first remove the stump or decayed portion of the old pole, and then make an excavation of sufficient size to allow the pole socket to be easily inserted up to the point where it has a constriction. The bottom of the socket is then filled with either dry earth, shale or concrete to within one foot of the ground surface. This inner filling is firmly tamped. A thick grout is then prepared and poured into the socket to a point above the constricted ring. Everything is now ready to receive the pole, which is raised with a jack, moved into position over the socket and then allowed to enter the same. As it does so, it squeezes the grout up and around the pole, filling all of the space between the pole and the socket up to its upper edge. The pole is made and held plumb while the grout hardens. In some instances a shell of concrete three or four inches thick is rammed about the socket to about a depth of two feet below ground surface.

The entire cost of repairing an old pole with a socket of this character does not exceed $10 per pole of large size, and $6.50 for a small pole, which is very low compared with the total cost of placing a new pole. The pole is entirely protected at its weak point and is made fully as strong even stronger than when it was originally set. There is no disturbance of the overhead wiring or cross-arms at all and the work of installation can be rapidly done. These sockets are made by the National Pole Socket Company, Pittsburgh, Pa.



Section Showing Pole Socket Arrangement.

Socket Ready for Inserting the Pole.

A New Method of Coating Iron With Zinc.

Patents have been recently issued to Charles F. Burgess, of Madison, Wis., for a new process of coating iron or other metals with an alloy of zinc. The process is somewhat similar to sherardizing and the object is to replace that process or the more ordinary methods of galvanizing.

The objects to be coated are placed in a rotating drum with the coating material and heated to a temperature of about 850 degrees Fahrenheit. Iron articles will then become coated with a protective layer of silver-like appearance and a matt surface. This layer consists largely of an alloy of iron and zinc having a composition $FeZn_{10}$. This coating is hard and dense in structure, being harder than pure zinc. Its electrochemical contact potential is less than that of zinc as measured in the usual way with a calomel electrode against a normal zinc solution. It is electropositive with respect to iron, but only slightly so, consequently it protects the iron from corrosion without being itself subject to rapid wast-

The Pole Reinforced and As Good as New.

ing away through electrolytic action. For this reason it is considered superior to a coating of pure zinc.

To prepare the alloy, commercial zinc dross is broken into lumps and placed in a rotating iron drum with wrought iron in small pieces. This charge is heated to a red heat and if the materials are in the proper proportion the iron combines with the dross, forming the alloy. This alloy is exceedingly brittle and the rotation of the drum causes the lumps to grind on one another, reducing the entire charge to small granules. The alloy can be heated to 1,300 degrees Fahrenheit without fusion, being in this respect quite different from pulverized zinc, which fuses at about 740 degrees Fahrenheit. In using the alloy for coating it is desirable to have an excess of zinc present. This can be arranged by adding lumps of zinc or of the dross to the tumbler.

The patents have been assigned to the United States Sherardizing Company, of New Castle, Pa.

The Marconi Decremeter.

The Decremeter.

The decremeter, as made by the Marconi Wireless Telegraph Company of America, 27 William Street, New York, N. Y., consists of a resonating circuit containing inductance coils in series with a variable condenser, and a detecting circuit which can be connected with the resonating circuit in a variable manner. The detector circuit consists of a telephone receiver and a crystal rectifier consisting of carborundum held between metallic clips.

The inductance consists of three parts; the first consists of three turns of thick wire and is mounted in the lid of the box. In series with this is a coil of 32 turns wound upon a narrow tube, with a sliding contact for adjustment. The third is a coil of definite inductance designed to throw a circuit which has been tuned out of resonance by a definite amount—four per cent. This variable condenser is calibrated at a high frequency so that the capacity corresponding to each reading is known. Adjustment of the condenser permits the circuit to be tuned to resonance with any outside source of oscillating electromotive force within the range of the instrument. By constructing the coil of low resistance and the condenser with high insulation and small absorption, the circuit is almost free from damping. This circuit has been previously calibrated against a standard so that for any setting of the condenser the wave-length or frequency can be read off from a table which is supplied with the instrument.

The instrument is arranged to measure not only wave-length, frequency, capacity and inductance, but also damping. Small capacities are measured by placing them in parallel with the condenser and noting the adjustment of the latter, which is necessary to regain resonance. Larger capacities can be measured by inserting them in series. Inductances are inserted in series and their values obtained from the table by taking two readings of a wave-length, one with and one without the unknown inductance.

To determine the decrement of any oscillation, the strength of the signals is equalized when the circuit is in tune, and when the circuit has been thrown out of tune by a known small percentage. With coupled circuits difficulties may be encountered and it is recommended to plot a curve of resonance. This is also recommended in the case of signals which are very much damped.

The instrument is shown in the accompanying illustration. One aim in its design has been portability, and the weight of the complete apparatus is only 13 pounds. The case measures 14 by 9 by 4.5 inches.

Advantages of Electric Drive.

The rapid growth of the use of electricity is evidenced by the fact that of the hundreds of thousands of students who have taken courses at the International Correspondence School at Scranton, Pa., 225,070 have taken courses in electrical engineering as against 126,788 who have taken courses in mechanical engineering and 124,045 who have taken courses in steam engineering.

The *Electrical Engineers' Handbook* published by that institution points out that the individual motor drive, under ordinary working conditions, is more than three times as efficient as the line shaft and belt drive. It says: "The power required to drive the line shafting and belts in a factory where the motive power is all in one source is about equal to the power required to drive all the machines in the shop at their maximum output; that is, if all the tools working simultaneously at maximum output require 100 horsepower, the belts and shafting will require about 100 horsepower more, and this power, which is all lost in friction, must be supplied all the time, even though only a few of the machines are working. On the other hand, if, in the same shop, each tool is equipped with a motor, only about 43 horsepower will be lost in transmission from the motive power of the dynamo to the tools when they are all working at maximum output; that is, 143 horsepower is consumed and 100 horsepower, or 70 per cent of this, is supplied to the tools, against 50 per cent with belts and shafting. But, in machine-shop work, it is found that so many machines are always idle or working on light load that only about 30 per cent of the total capacity of all the machines is in use at the same time; that is, the load-factor is approximately 30 per cent. With line shafting and belts, the total power supplied to the shop is then 130 horsepower, of which 30 horsepower, or 23 per cent, is used by the tools. With individual motor drive, the losses decrease approximately as the load. At 30-per-cent load, the loss would be 30 per cent of 43 horsepower, or 13 horsepower, and the total power is 43 horsepower, of which

30 horsepower, or 10 per cent, is used. In other words, the individual motor drive, under ordinary working conditions, is more than three times as efficient as the line shaft and belt drive.

"However, it would not usually be economical to install a small motor on each of a number of small machines; better results are often obtained by driving a number of small machines in a group from a comparatively short line shaft driven by a larger motor."

Water-Cooled Turbo-Generators.

The great compactness and consequent small surface of turbo-generators of large capacity requires that positive means of cooling them be provided. This has heretofore been done exclusively by means of air blast, either self-induced or under pressure. Horizontal machines have been readily adapted to this requirement but for vertical machines a large air duct has had to be built along side the turbo unit.

To dispense with this rather cumbersome feature, Henry Geisenhöner, of Schenectady, N. Y., has invented a water-cooling system for the stators of these machines. His method has just been patented and assigned to the General Electric Company. The necessary equipment is extremely compact. It provides not only a very effective cooling arrangement, but permits the utilization of the heat developed in the generator for the initial warming of boiler-feed water.

Large transformers are now commonly water-cooled, even though their voltage is greatly in excess of that developed in the largest generators. This principle had not been employed in the cooling of turbo-generators, however. Its feasibility is now apparent. It is true, of course, that it cannot be used for cooling the rotor, but for that part of the machine the present self-induced draft is well adapted.

Small Turbines Installed.

The advance of the small steam turbine has been remarkable. There seems to be no limit to the variety of uses to which it can be put. Statistics carefully compiled by one of the leading small steam-turbine companies show that steam turbines are driving centrifugal pumps in over 55 different kinds of service, while they are extensively used for driving generator sets, force-draft blowers, gas blowers, cupola blowers, etc. Transitions due to the small steam turbine are daily seen and one which is rather interesting is the case of the Great Atlantic and Pacific Tea Company's plant at Jersey City, N. J. Three years ago this plant consisted of two 200-kilowatt Corliss engines direct-connected to generators. To this plant was added a 150-kilowatt Terry turbine-driven generator outfit. The results were so satisfactory that in 1910 one of the 200-kilowatt Corliss engines made way for a 200-kilowatt Terry turbine-driven generator set and now the other Corliss engine is being replaced by a similar steam-turbine set of 300 kilowatts. This means that at this plant in three years a complete change from reciprocating engines to small turbines will have been made.

Flaming-Arc Lamps with Adjacent Carbons.

The first electric arc lamps which were put in practical use—those of Jablochkoff in Paris in 1878—had carbons which were arranged beside one another instead of end-to-end as now commonly placed. There is now reversion to this arrangement for special cases. Lamps of this type have a very strong radiation from above downwards and but comparatively little lateral radiation, and are poorly suited to the illumination of large areas. But they can be employed for this purpose, by surrounding the arc with a number of refracting prisms, regularly united to a bell-shaped inner glass. Such arrangement of prisms should naturally not be subjected to the action of the deposit from the burning carbons. It is therefore necessary to employ, for these lamps, mountings which are not subject to such deposits. For this purpose the Siemens-Schuckert Works has made a special type of lamp, which it claims to be equal in lighting effect to the type with carbons placed end to end. For this type, tests go to show that the illumination of the ground or floor between any two lamps is almost twice as brilliant as without prisms; that it is regular in intensity, doing away with the alternating brilliant and very dark places; that the height at which it is necessary to hang the lamps is less (which of course permits a saving in the cost of masts); that for a given degree of illumination the distance between lamps may be less; that the cost of attention is decreased; that the otherwise blinding effect of the flaming arc is done away with, as for the outer globe there may be employed either clear glass, or that which is but slightly opalized.

The illustration shows a wharf lighted with an arc lamp with the surrounding prisms.

In order to fully utilize the advantages of these, it is necessary to pay special attention to the form of the outer glass, in order that the rays of light which have been once refracted by the prisms, may not be sent sideways and upwards, but turned as nearly as possible vertically downwards.

Installation of Siemens-Schuckert Flaming Arc Lamps.

The Magic Cleaner.

The Magic electric suction cleaner has recently received several marked improvements and is guaranteed for five years by the Rosenfield Manufacturing Company, of New York City. The general appearance and efficiency of the machine and attachments have been greatly improved. This machine is of light weight, is carried on wheels and has a tilting handle. All moving parts are inclosed in solid aluminum castings and the weight is only ten pounds. It is a fan-type machine and displaces a large volume of air. The motor used is made by the Westinghouse Electric & Manufacturing Company and operates upon either direct or alternating current. The suction nozzle has been increased to a width of 10.5 inches. A switch has been placed on the handle. Two new attachments have been added to the equipment.

The New South Wales Government Railways have ordered from the General Electric Company a 5,000-kilowatt, 6,600-volt, horizontal Curtis turbo-generator.

Transformers for 140,000 Volts.

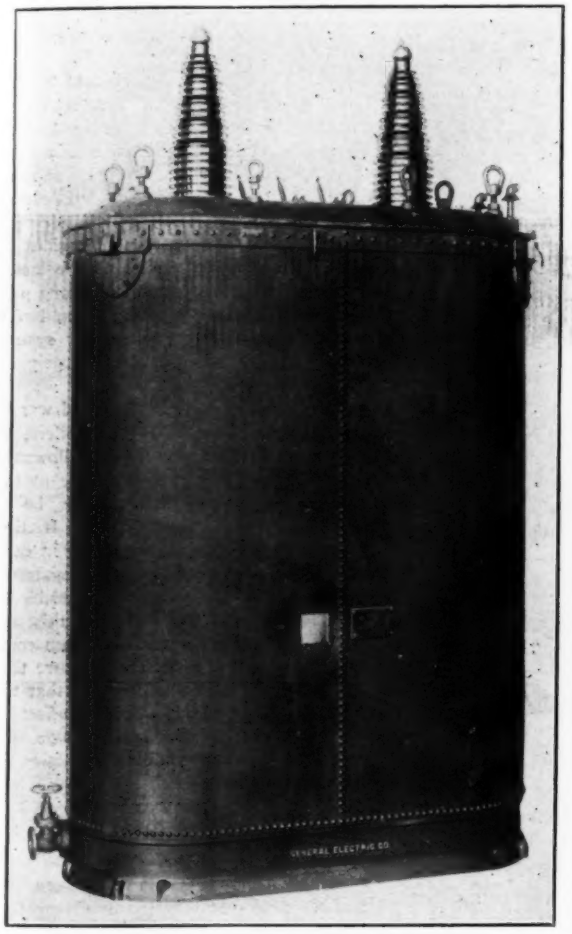
In the manufacture of transformers, the General Electric Company, year after year, has been called upon to develop units which, either in capacity or voltage, exceed anything in use. In the past year, two three-phase water-cooled units of 12,000-kilowatt-ampere capacity and two similar units of 14,000-kilowatt capacity have been built for the Shawinigan Power Company. The latter units represent an increase of 4,000 kilowatts over the capacity of the General Electric three-phase transformers built for the Great Western Power Company, which capacity has been equalled by other General Electric transformers but not previously exceeded by any manufacturer.

About two years ago the Stanislaus Power Company was supplied with seven transformers designed for a voltage of 138,500. This was at that time the highest voltage ever used commercially. At the present time, the General Electric Company is building transformers which will mark another increase in voltage to be applied to commercial purposes. The Eastern Michigan Power Company is being supplied with twelve single-phase sixty-cycle, 3,000-kilowatt transformers designed for delta connection on its 140,000-volt power-transmission system.

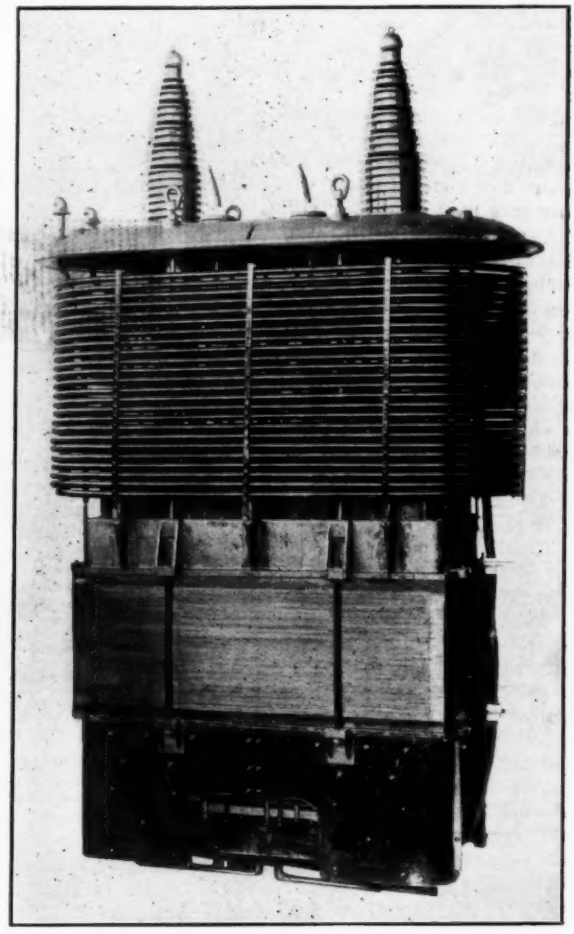
These transformers occupy a floor space of about 11 by 5 feet, having a total height of approximately 19 feet from floor to the top of the high-tension terminals. Each transformer will contain about 4,000 gallons of oil. In addition to the high primary voltage for which these transformers are intended, the design is of special interest in that the transformers, to meet various low-tension conditions, are arranged for the following secondary voltages:

Three transformers are designed for a secondary voltage of 2,470 volts in one circuit. Three transformers are designed for simultaneous service on four secondary circuits of 370 volts with 125 kilowatts capacity each, one secondary circuit of 5,560 volts with 1,000 kilowatts capacity and one secondary circuit of 44,000 volts with 1,500 kilowatts capacity. Three transformers are designed for one secondary circuit of 370 volts with 125 kilowatts capacity, one secondary circuit of 5,560 volts with 2,250 kilowatts capacity and one secondary circuit of 22,000 volts with 500 kilowatts capacity. The three remaining transformers are designed for two secondary circuits of 370 volts, 125 kilowatts capacity each, and one secondary circuit of 22,000 volts and 2,750 kilowatts capacity.

Standard oil-filled leads are provided. These leads have an overall dimension of 7 feet 4 inches and contain about 30 gallons of oil each. They are provided with cast-iron bases which are fitted to the cover and which extend down into the tank, well under the oil. The end is equipped with a brass ball and the whole lead has been developed with the ultimate aim of reducing the possibility of corona effects. These transformers are designed to withstand a test of 280,000 volts from the high-tension winding to all other parts. The oil-filled leads are also subjected to the same high-tension test.



140,000-Volt Transformer Complete.



Transformer With Case Removed.

The Piedmont & Northern Lines to Use the Telephone for Train Dispatching.

One of the great electric traction systems of the South, the Piedmont & Northern Lines, is about to enter the telephone train-dispatching field, and with this end in view has placed orders with the Western Electric Company for equipment to be used on two of its lines.

The first of these, the Piedmont Traction Company, is to operate its cars over a 24-mile stretch of line extending from Charlotte to Gastonia, N. C. There will be seven way stations located along the line as well as eight semaphores of the new selectively operated type.

The second line is that of the Greenville, Spartanburg & Anderson Railway, which will install telephone equipment over approximately 58 miles of road from Greenville to Greenwood, S. C. Eleven way station equipments and eight semaphores will be installed.

The equipment to be used is of the very latest type throughout. The selectively operated semaphore is a new development and is operated by the dispatcher by means of a selector key in the same manner that a way station is signalled. An "answer back" or audible signal informs the dispatcher when the semaphore has operated.

A New Color-Matching Light.

The light from a clear north sky, the ideal light for color matching, has always been sought by manufacturers who depend upon the proper matching or selection of colors as an important part of their business. On dark or rainy days the absence of this much desired light places a most effective brake upon the output.

Some of the industries that have required such light are the manufacture of wool, cotton and silk goods, dyeing and dye-stuff making, lithographing and printing-ink manufacture. The tobacco and leather dealers, in sorting the various grades of material, also require the closest attention to color values, and they have, therefore, been in a measure dependent upon this light.

The General Electric Company has evolved a color-matching outfit which has a spectrum similar to that of a clear north sky and is a marvel of simplicity. The device consists primarily of an intensified arc lamp with a special casing and an ingenious arrangement of glass screens which remove the excess of red, orange and violet rays found in the spectrum of the arc. It is claimed that this intensified arc lamp is the nearest approach to daylight of any commercial artificial illuminant and thousands are being used in the leading department stores of this country.

The color screens consist of a number of colored strips arranged side by side to take out the excess rays, and a diffusing glass whose function is to mix the light.

These glasses are made up in the form of a circle about 16 inches in diameter and are placed in the large end of a conical hood which is attached to the casing of the lamp. This hood surrounds the inner globe and is given a reflecting surface so that the light is projected down through the color screen and the direct rays are kept from the eyes of the user.

New Pelouze Percolator and Chafing Dish.

The Pelouze Manufacturing Company has added to its well known line of electric heating appliances a new coffee percolator and a new chafing dish. The former is known as the Pelouze-Universal percolator. It is designed to heat the water very rapidly and continually pump it over the ground coffee, through which it percolates into the pot again. The finished coffee is of fine flavor and delicious aroma and is entirely free of the bitter taste caused by the old method of boiling. These percolators are exceptionally efficient, consuming only 250 watts. They are made in several graceful designs. The material is spun copper, thoroughly nickel-plated and ornamented with cast-bronze mountings.

Pelouze Coffee Percolator.

Pelouze Chafing Dish.

In the new chafing dish there is embodied an efficient self-contained heating unit that can boil water in seven minutes with a consumption of only 450 watts. The designs are attractive on account of their artistic outline, bronze ornamentation and highly nickeled finished.

Where Superheating Did Not Pay.

That the cost of superheated steam may easily be greater than the gain in efficiency from its use is shown in a recent investigation made by Arthur D. Little, Incorporated, of Boston, Mass. The question at issue was whether it was worth while to add 75 degrees of superheat at the boliers of a plant which consisted of six 400-horsepower Babcock & Wilcox boilers located in a central house, and supplying steam to centers of distribution of pipe lines respectively about 120, 350 and 600 feet in length. The pipe lines from these centers to the various engines and heating systems had been used for several years, and it was desirable on grounds of expense to continue to use them if such use did not interfere with the economy of the power use.

It appeared that the greater expansion and contraction of the pipe lines that would be caused by superheated steam would give the piping a greater strain than had been previously put on it, and would mean a good deal of overhauling of valves and joints. Calculation showed that the proposed 75 degrees of superheat, moreover, would ultimately add very little to the efficiency of the engines in the different mills, because of the losses due to transmission through the long pipe lines. Greater superheating would demand practically a complete new system of piping, and was discarded largely on that account.

The course finally recommended was to omit the superheaters at the boilers, to design the new pipe lines with allowance for considerable loss of pressure at the greatest loads, to increase the boiler pressure enough to overcome the friction in these pipe lines, and to set up in each mill a large receiving tank and separator, well insulated, and as near as possible to the engine. It was held that this arrangement would deliver the steam comparatively dry, at about the pressure that had been customary before, and that the slight loss in efficiency would be offset by the lesser cost of the smaller pipe system and the corresponding reduction in radiating surface.

Oerlikon Special Slow-Speed Alternators.

In hydroelectric plants where the head of water is only ten or fifteen feet and slow-speed turbines with vertical shafts are used, it is now coming to be the general practice to avoid using bevel gears between the turbine and the alternator, since such gearing is bulky and wastes much energy, besides being expensive to maintain.. For this reason the alternator is mounted directly on the turbine shaft in the most recent European practice. This has led to the designing of special alternators to meet the case. Herewith are illustrated several of the newest types which the Maschinenfabrik Oerlikon, of Oerlikon, Switzerland, is now producing. A typical installation is the city electric plant of Schaffhausen, in which there are five alter-

nators installed. The Erlenholz plant uses a machine of another design, and we illustrate a third design employed in a plant at Lauffen. All these machines are to be remarked for their slow speed.

In Fig. 1 is shown a twenty-eight-pole, three-phase alternator, rated at 285 kilowatts, 2,000 volts and fifty-three cycles. It is mounted on the vertical shaft of a turbine running at 227 revolutions per minute, and replaces a horizontal-shaft alternator which was driven by bevel gearing. This change allowed of increasing the efficiency and power of the plant. The stationary body of the machine is made up of four parts superposed, namely, the lower casting with four radial arms, the main stator body of cylinder shape, upon this comes the upper casting having four radial arms, and on the top is a cylindrical casting for the exciter. The stator ring is here cast in a single piece, and to it is bolted the laminated iron part, having the winding in half-open slots.

The rotor has the main body in the shape of a flywheel cast in a continuous disk, to which the pole pieces are bolted. Copper strip winding is used. At the upper part, the collector rings can be reached by openings in the bell-shaped casting. On top is the exciter commutator with brush-holder in a convenient position. The shaft is connected directly with the turbine shaft by a bolted plate coupling, so that all the weight is supported by the bearing of the turbine.

Of another design is the alternator seen in Fig. 2. It is built for three-phase, 1,600-volt, forty-cycle service, and is mounted on the shaft of a 420-horsepower turbine running at sixty revolutions per minute. Two sets of this kind have been supplied to the Wurtenberg Portland Cement Works at Lauffen. On the shaft is an internal revolving field with radial arms, which is visible and forms the inside and upper part of the machine. It can be lifted out without dismounting anything but the bearings. The design allows of reducing the stator body to two superposed pieces. Below is a casting with six radial arms carrying at their ends the same number of pedestals bolted to the foundation. Above is the main ring casting of the machine. Underneath are the collector rings, and these are mounted below the shaft coupling.

The municipal plant of Schaffhausen contains five alternators of another design, these being single-phase or three-phase machines of eighty-pole type, giving 525 kilowatts, with $\cos \Theta = 0.7$, at 2,000 volts and 50 cycles. They are coupled to 750-horsepower turbines running at 75 revolutions per minute. Of similar design are the three-phase machines used in a plant at Bremen (Figs. 3 and 4). These generators are worthy of note for their unusually slow speed of forty revolutions per minute. They are built for 7,000 volts, fifty cycles, 500 kilowatts, and are mounted on a 750-horsepower turbine. These alternators have an internal revolving field, and the outer part is made up of three superposed castings, a lower radial-arm casting, then the main cylindrical body, and on top a casting with

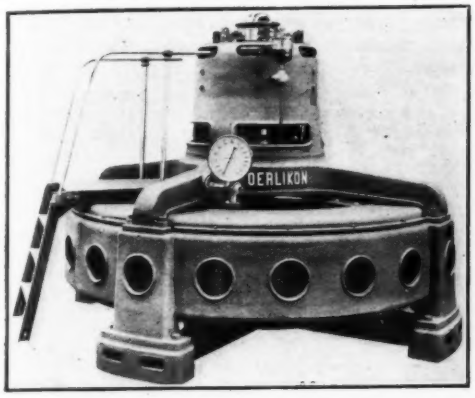


Fig. 1—Direct-Connected Water-Wheel Generator.

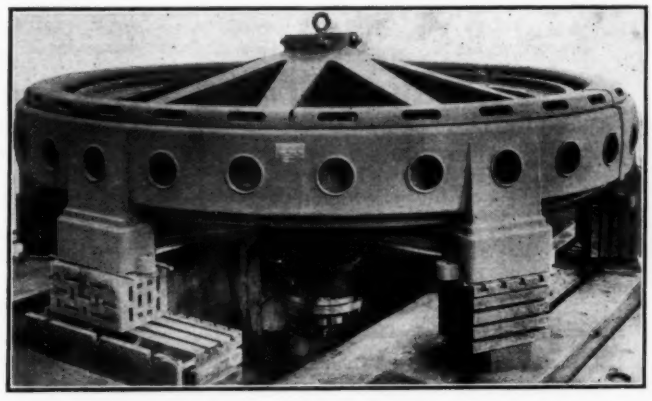


Fig. 2—Slow-Speed Water-Wheel Generator for the Lauffen Hydroelectric Plant.

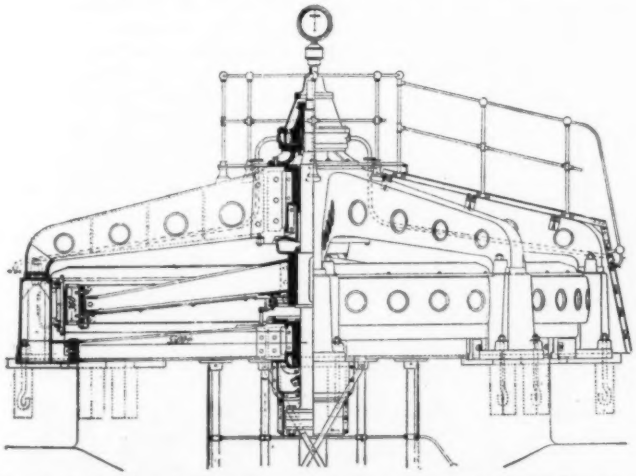


Fig. 3—Section and Elevation of Bremen Generators, 40 Revolutions per Minute.

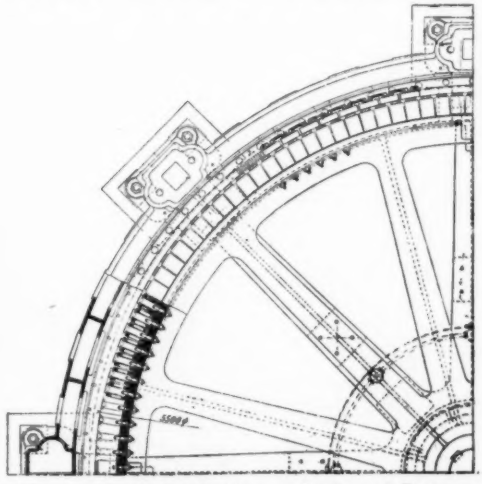


Fig. 4—Quadrant Section and Plan of Bremen Generators.

heavy radial arms carrying the upper bearing. Unlike the former designs, the present machines carry an upper bearing which takes the weight of the revolving parts. The lower part of the bearing is of ring shape and upon it rotates a friction plate which is screwed on the shaft end, this latter being threaded; the friction parts run in oil. The casting of the bearing is water-jacketed and the water pipes run along and inside the radial arms. The field consists of a flywheel carrying 150 poles.

Wireless Storm Detectors and Indicators.

The coherer and other wave detectors are very successfully used by Professor Turpain, of the Potiers University,

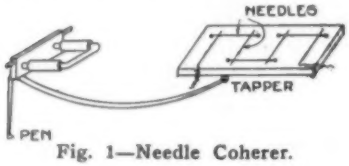


Fig. 1—Needle Coherer.

France, in order to observe and record the electrical state of the atmosphere. A very practical use of his apparatus is to foretell approaching storms, and these can be observed as much as four hours before they arrive. At La Rochelle, France, Professor Turpain has erected a storm-observation post, and he uses an aerial based on the same principles as for wireless work. The aerial is mounted at a point about eighty feet above ground, and is brought down on a slope to a second point and thence into the station, giving a total length of 300 feet in all. In order to make a record of the waves he uses a coherer made up of a set of crossed steel needles, using four parallel needles having three others laid on them, as the accompanying diagram (Fig. 1) shows. The proper pressure is given by using small weights on the upper needles, and thus six contacts are obtained in

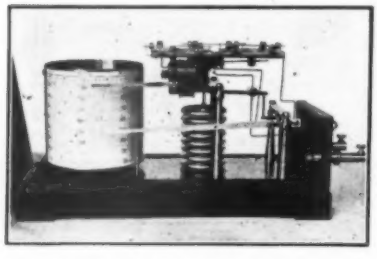


Fig. 2—Needle Coherer and Aneroid Barometer.

series by this method. Such a coherer is mounted on a light board and underneath is mounted an electromagnetic tapper of the usual kind which strikes the board, as shown in Fig. 2.

The first form of instrument has a storm indicator combined with a Richard aneroid barometer, and both give a record upon a common revolving drum. One cell of Leclanché battery is used with the coherer. Each of the latter's six contacts receive 0.25 volt per contact, which is found to be the best condition. As the diagram shows, the electromagnet has an armature carrying the tapper and also the light arm for the recording pen. In this way the atmospheric discharges are recorded on the drum parallel to the barometer record. The present instrument is designed to observe the frequency of the atmospheric discharges and from this there can be made deductions as to the electrical state of the atmosphere.

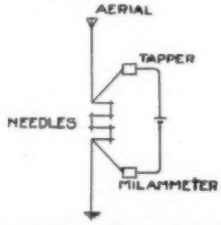


Fig. 3—Circuit With Milammeter.

A second instrument is used by Professor Turpain in which the indications are more precise than in the above. The apparatus is a very sensitive one and needs special precautions to secure the proper mounting. It consists of the same coherer as already described combined with a sensitive milammeter, this being

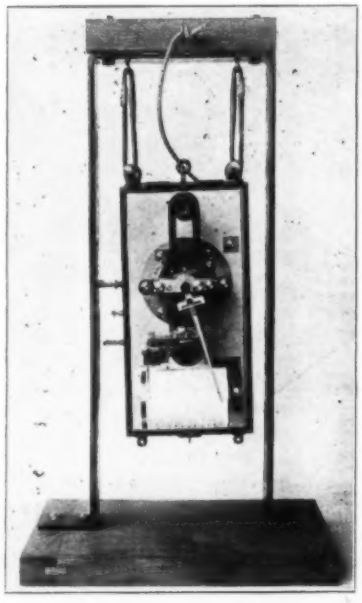


Fig. 4—Arrangement of Apparatus With Milammeter.

connected in series with the battery and tapper; see Fig. 3. With this instrument, the variations in the current through the coherer are recorded on the drum, and it gives reliable indications as to approaching storms. To this effect one observes the current variations up to the point where the cohering action takes place. When a storm cloud acts on the aerial, the successive states of cohering of the contacts allow a greater or less current to pass in the circuit, and these values are recorded on the drum. This action occurs until the atmospheric discharge becomes of such strength that it produces a greater cohering action and this is enough to bring the tapper into play. The coherer thus comes back to normal and the apparatus is ready to make a new record, and so on. The drum thus

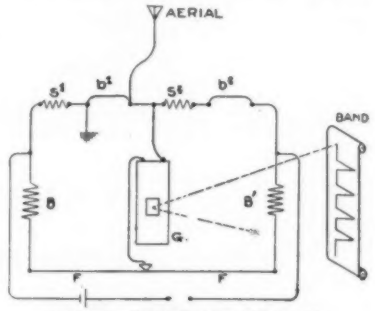


Fig. 5—Bolometer Method.

carries a series of such records following each other. As the instrument needs to be well protected from shocks, it is found best to suspend it by stout rubber bands, as shown in Fig. 4.

Professor Turpain finds that the energy of the atmospheric discharges is best measured and recorded by another apparatus in which the bolometer principle is used. Two very fine platinum wires S^1 S^2 are used whose resistance varies with the passage of the waves, and these are connected to the aerial as shown in Fig. 5. They are balanced on the Wheatstone bridge principle against two fixed resistances B B^1 and a slide-wire resistance F F. In the circuit is a Richard reflecting galvanometer G which makes a record upon a moving photographic band. In this way the energy of the discharges can be observed, as according to the bolometer

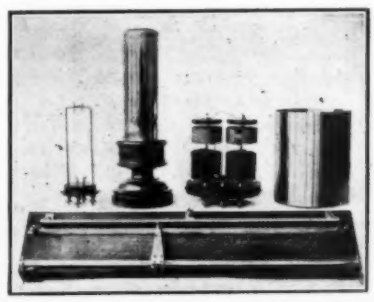


Fig. 6—Apparatus for the Bolometer Method.

principle the swing of the galvanometer is quite proportional to the square of the intensity of the discharge. The photograph, Fig. 6, shows the fine platinum wires which are stretched on a support and placed inside a Dewar silvered vessel in order to protect them from the heat.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

ELDORA, IOWA.—The Eldora Light Company has been granted a franchise to install an electric light plant.

DULUTH, MINN.—This city has voted $750,000 in bonds for an electric light plant.

DULUTH, MINN.—The city has voted $750,000 for an electric light plant. C.

JENNINGS, MO.—C. C. Johnson has been granted an electric light franchise.

OAKWOOD, TEX.—A. J. Howeth is about to install an electric light plant here.

MOVILLE, IOWA.—Edgar Metcalf plans the erection of an electric light plant.

REMSEN, IOWA.—M. R. Faber has been granted an electric light franchise here.

PLAINS, MONT.—The city plans the installation of an ornamental street-lighting system. A.

LINTON, IND.—The Town Board has voted to install cluster lights on the business streets. S.

GLOBE, ARIZ.—The Live Oak Mine contemplates installing new air compressor machinery. A.

ALTON, IOWA.—It is reported that Alton is going to have a new electric light plant.

HONDO, TEX.—W. B. Sorelle, of San Antonio, has been granted an electric light franchise.

MORNING SUN, IOWA—P. A. Yohe has been granted a franchise for an electric light plant.

EDNA, TEX.—E. F. Glaze has purchased the electric light plant here and will install improvements. D.

MILWAUKEE, WIS.—The Commonwealth Power Company will greatly enlarge its present plant.

CORONA, CAL.—Bids for a 50-year lighting franchise for this city will be received up to March 19.

ZEPHYR HILLS, FLA.—Messrs. Frisco & Son are interested in the installation of an electric light plant.

CHILLICOTHE, MO.—This city contemplates the expenditure of $10,000 in extending its electric light plant.

FREDERICKSBURG, TEX.—The electric light and power plant here is to have installed two new dynamos.

ROCHESTER, N. Y.—The Rochester Last Works expects to construct a power house, at an estimated cost of $10,000.

NEVADA, IOWA.—The council has agreed to install cluster lights. Twenty standards will be placed on the streets. C.

LOWELL, MICH.—The Lowell dam will be rebuilt by the Grand Rapids-Muskegon Power Company some time this year.

KNOWLTON, WIS.—The Battle Island Company is about to erect a hydroelectric plant to develop 2,300 horsepower.

LONG BEACH, CAL.—The Southern California Edison Company plans to erect an electric lighting plant at Bixby Ranch. A.

ELDORA, IOWA.—The Eldora Electric Light Company has been granted a franchise to install an electric light plant. C.

LOUISVILLE, KY.—The Louisville Railway Company will erect a power plant on High Street, at an estimated cost of $300,000.

GLENDALE, CAL.—The city has voted favorably on the issuance of electric-light bonds and construction work will start immediately.

SAN BERNARDINO, CAL.—The city plans the installation of an electrolier lighting system in the business section. B. F. Bledsoe is interested. A.

MEIGS, GA.—Mayor E. E. Wilkes will open bids about April 1 on construction of an electric light plant of 200 or 300 horsepower capacity.

WINTERS, TEX.—The Winters Light & Power Company is about to increase its capital stock from $7,500 to $10,000 and enlarge its plant.

CONNEAUT LAKE, PA.—A committee of citizens is being formed to have in charge the matter of installing a municipal electric lighting system.

VINTON, IOWA.—Plans have been made for the erection of a new power house to be built on the bank of the Cedar River at an estimated cost of $20,000. C.

DANVERS, ILL. — The Village Board is reported to be contemplating the installation of an electric pumping system at the waterworks station in Danvers. Z.

WHEELING, W. VA.—The Wheeling Traction Company has decided to spend $1,000,000 on improvements, including a power plant in South Wheeling.

BEDFORD, IND.—The Rose Stone Mill, operated by electricity, has been destroyed by fire entailing a loss of $50,000. The plant will be rebuilt at once. S.

DAYTON, O.—The Hetzel Light & Heating Company has been incorporated with a capital stock of $10,000. The incorporators are Robert F. Hetzel and others. Z.

SAN JACINTO, CAL.—The Southern Sierras Power Company will soon commence the construction of its proposed power line in the San Jacinto Valley. A.

ALAMO, TENN.—The Alamo Light & Power Company has been granted a franchise for the installation of a light and power plant within six months.

BIWABIK, MINN.—The town clerk has been instructed to advertise for bids for ornamental street lighting for five blocks; offers to be opened March 9.

LAS VEGAS, NEV.—The Muddy Valley Irrigation Company contemplates the erection of two electric power plants. These plants will be fully equipped. A.

SACRAMENTO, CAL.—The Carly Company plans the installation of electric power lines throughout their property recently acquired south of Sacramento. A.

SALT LAKE CITY, UTAH.—The City Commissioners have empowered Commissioner Nelson to have the new tungsten system of street lighting installed at once.

VALLEY CITY, N. D.—The Commercial Club is agitating the installation of ornamental street lights with clusters, at the intersection of streets in the business district. C.

BELLINGHAM, WASH. — The Board of City Trustees plans the installation of an ornamental cluster street-lighting system on Holly, Bay and Prospect Streets. A.

PORTLAND, ME.—The York Power Company has been incorporated with a capital stock of $500,000. A. F. Dunham is president and clerk and M. S. Wells. treasurer.

PAXTON, ILL.—The City Council of Paxton has granted a thirty-year franchise for a power plant to the Consumers' Electric Light, Heat & Power Company. Work on the plant is to begin by March 6. Z.

MONTGOMERY, ALA. — The Horne Alabama Electric & Power Company has tentative plans for the expenditure of $3,000,000 on developing power on the Coosa River.

NAMPA, IDAHO.—The Southern Idaho Light, Heat & Power Company plans to construct a new depot for the Nampa-Caldwell Electric Company. A site has been acquired at Nampa.

SPRINGFIELD, ILL.—Sealed bids will be received until March 11 by the Board of Administration, Springfield, Ill., for electric wiring in laundry building at the Soldiers' Orphans Home in Normal. Z.

DUBLIN, TEX.—Henry Weiser and Frank Weiser have purchased the electric light plant here from the Dallas Securities Company. It will be moved to another part of town and improved. D.

BOSTON, MASS.—Nearly $20,000,000 worth of subways, elevated lines, power houses, surface line construction and new equipment will be put into use by the Boston Elevated Railway Company in 1912.

WEED, CAL.—The Siskiyou Electric Light & Power Company plans to build a substation for the purpose of furnishing the Weed Lumber Company

with electricity. F. DeMooy, Weed, Cal., is interested. A.

CLARKSVILE, ARK.—Bids will be received until March 1 for the construction of a 200-horsepower electric light plant. W. N. Gladstone is the consulting engineer ,and T. E. May, chairman of the Board of Improvement.

TOYAH, TEX.—The Toyah Light & Ice Company has entered into a contract with the city council for lighting the town. A number of street lights will be installed and improvements will also be made to the company's plant. D.

SAN FRANCISCO, CAL.—The Midland Counties Gas & Electric Company has filed articles of incorporation with $1,000,000 capital stock. The incorporators are W. A. Nunlist, J. J. Welch, P. W. Webb, J. A. Williams, and W. C. Crittenden.

EAST CONEMAUGH, PA.—The East Taylor Light, Heat & Power Company has been incorporated with a capital stock of $5,000. The incorporators are Howard Davis, C. B. Custer and M. J. Davis. B. B. Custer is treasurer of the company.

NEWPORT, IND.—The City Council has decided to install a lighting system and will transmit by overhead-wire current from Cayuga, a distance of 12 miles. The board has agreed to pay $42 a year for a period of ten years for 200-candlepower Tungsten lamps. S.

OSCEOLA, ARK.—The city will open bids about March 10 for the construction of an electric light plant and for machinery for same, including direct-connected units, boilers, switchboard and distributing system. W. N. Gladstone, Fayetteville, is the consulting engineer.

GRAY, ME.—The Gray Light & Power Company has filed articles of incorporation with a capital stock of $10,000. D. D. Elliott, Monmouth, is president; M. M. Elliott, Monmouth, is treasurer and clerk. The purpose of the company is to furnish electricity to Gray and New Gloucester.

MATHERSVILLE, ILL.—The Mathersville Light & Power Company has been incorporated with a capital stock of $10,000. The company will do a general electric light, heat and power business. The incorporators are Paul Wagner, J. W. Walsh, John J. Ryan, H. C. Lightner and W. W. McCullough. Z.

PECOS, TEX.—W. C. Wilson of Hoban is promoting the installation here of a large central electric power plant and the construction of a system of transmission lines to provide power for operating irrigation pumps throughout this section. It is reported that the plans for carrying the project out are well advanced. D.

CHAMBERSBURG, N. Y.—A big power plant to supply electricity for the Cumberland Valley from Carlisle to Hagerstown and Frederick, Md., is planned to be located on Broad Top, 40 miles west of here. Engineers have been at work gathering data, and it is said that New York capital is at the back of the project.

ACAPULCO, MEX.—A large hydroelectric plant will shortly be constructed on the Balsas River at the point where the main highway between Chilpancingo and Iguala crosses the same. The plant will supply power for the many important mines in the state of Guerrero along the Balsas River. It is said that $14,000,000 is behind the project.

MONTGOMERY, ALA.—Charles H. Baker, of New York, has announced that the Birmingham, Montgomery & Gulf Power Company contemplates developing water power on the Tallapoosa River at Cherokee Bluffs, near Alexander City, at a cost of about $3,000,000. Mr. Baker states that 30,000 horsepower will be continuously provided by the power plant.

SAN ANGELO, TEX.—The San Angelo Power & Street Railway Company is the name of the reorganized corporation which has taken over the street railway system here from J. D. Sugg. It is announced that the new company will erect a power house, purchase a large amount of equipment and extend the system. It is to be placed in first class condition. D.

HAGERSTOWN, MD.—Henry Holzapfel, Jr., president of the Hagerstown Electric Railway Company, announced last week that the company would build a new power house to cost about $250,000. The railway has just passed from the control of Harrisburg (Pa.) owners into the hands of Washington and Frederick County (Md.) capitalists and extensive improvements in the roadbed and rolling stock are also contemplated. The site of the power house will probably be on Antietam Creek at Security, two miles east of Hagerstown.

INDIANAPOLIS, IND.—The Tippecanoe River Electric Company, capitalized at $300,000, has filed articles of incorporation with the Secretary of State. The incorporators are James W. Lilly, Alexander C. Ayers, Walter D. Jones, William W. Hammond and F. C. Ayers, who declare that large things are planned for the construction of at least three dams and the development of hydraulic power along the Tippecanoe river between Monticello and Springboro. It is understood that this company will take over the McKain water power sites and condemn a large acreage for reservoir purposes above each dam. S.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

KING, N. C.—The Quickstep Telephone Company will construct a telephone line from King to Meadows.

FERGUS FALLS, MINN.—The Friberg Telephone Company has been organized with a capitalization of $3,500. Ferdinand Peters is president. Z.

BRENHAM, TEX. — The Mount Vernon-Brenham Company has been organized to construct a five-mile telephone line.

MILWAUKEE, WIS.—The bids for the fire and police alarm systems will be let soon. The materials will cost about $30,000. C.

THIEF RIVER FALLS, MINN.—The Clover Leaf-Goodridge Telephone Company has been formed to install a rural telephone line. C.

ORIENT, WASH.—Fred Shriner contemplates building a telephone system to connect Orient, Tossburg, Napoleon and Boyds, Wash. A.

BLACKWELL, OKLA.—The Lone Tree Telephone Company has been incorporated by O. C. Diemer, C. R. Gargraves and S. E. Williams.

GRACEMONT, OKLA.—The Gracemont & Hillsdale Rural Telephone Company has been incorporated by John F. Pope, W. C. Drake and W. V. McFarland.

WASHINGTON, MISS.—The Cumberland Telephone & Telegraph Company will extend its system from Washington to Fenwick; also from Natchez to Sligo Plantation, a distance of 15 miles.

BILLINGS, MONT.—The Mountain States Telephone Company has taken over the management of the Montana Eastern Telephone line here and at Beach, and will make various improvements. C.

GILLUM, ILL.—The Gillum & Old Town Mutual Telephone Company has been incorporated with a capital stock of $900. The incorporators are Dean Genders, J. C. Dooley and Wallace Denning. Z.

OSCO, ILL.—The Osco Mutual Telephone Company has been incorporated with a capital stock of $2,000. A. R. Westerland, R. G. Neville, C. H. Anderson and Henry Bestor are the incorporators.

LOS ANGELES, CAL.—The Federal Telegraph Company, which has been operating a wireless telegraph system between this city and Kansas City, is now preparing to extend operations to Chicago.

SCHULENBERG, TEX. — The Brown Telegraph & Telephone Company has been incorporated with a capital stock of $15,000. The incorporators are M. L. Brown, C. B. Mohler and E. D. Brailey. Z.

PHILADELPHIA, PA.—It has been announced by the Bell Telephone officials that about $52,000 has been appropriated by the company for improvements and extensions throughout this immediate locality.

PRENTICE, WIS.—The Prentice Mutual Telephone Company was organized and will, as soon as weather permits, begin work installing a line. J. Sundquist is president; F. E. Morner, treasurer and J. A. Morner, secretary. C.

HENNING, MINN.—The Henning State Telephone Company has been incorporated to operate in Otter Tail County. The officers are: Charles Johnson, president; Ole E. Olson, secretary, and John Hanson, treasurer. C.

ELLENSBURG, WASH.—The Reecer Creek Telephone Company, recently organized by Samuel Kreidel, W. W. Spurling, and W. J. Cahoon, is planning the construction of a telephone system in Kittitas County, Wash. A.

PITTSBURGH, PA. — The North American Telephone & Telegraph Corporation has been incorporated with a capital stock of $10,000. The incorporators are Henry O. Evans, A. G. Nesbitt and Harvey I. Wilson. The company has been given the right to operate in all but a few counties in Northern Pennsylvania.

SALT LAKE CITY, UTAH.—The Grouse Creek Telephone Company, of Grouse Creek precinct, Box Elder County, has filed articles of incorporation with the Secretary of State. The capital stock is $2,500. C. J. Bush is president; Charles Kimber, vice-president and general manager; E. S. Frost, secretary and George S. Cook, treasurer.

ELECTRIC RAILWAYS.

(Special Correspondence.)

LOS ANGELES, CAL.—The Pacific Electric Railway Company plans to build a line from El Monte to Dominguez. A.

DAYTON, O.—The Springfield & Xenia Traction Company will probably build a branch from Yellow Springs to Davton.

PHOENIX, ARIZ.—The White Car Line has been granted a franchise on the county highway from Phoenix to Mesa, via Tempe.

LOS ANGELES, CAL.—The Pacific Electric Railway Company has been granted the right to electrify the old Santa Monica airline.

SUTTER CITY, CAL.—The Northern Electric Railway Company will soon commence the construction of a line through Sutter City. A.

WINCHENDON, MASS.—The Templeton & Athol Street Railway Company has been granted a franchise for a street railway line in this town.

PASADENA, CAL.—The Pacific Electric Railway Company has been granted a franchise to operate a road upon Washington Street in this city.

LOS ANGELES, CAL.—The Pacific Electric Railway Company plans for the immediate broad gauging of their line from Redondo to San Pedro harbor. A.

ANACONDA, MONT.—The Butte, Anaconda & Pacific Company plans to electrify its system throughout the city of Anaconda. The expenditure will be $1,000,000. A.

FAIRMONT, W. VA.—The Fairmont & Clarksburg Traction Company will soon commence the construction of a line to Weston, a distance of some thirty-nine miles.

LOS ANGELES, CAL.—The Pacific Electric Railway Company is planning to spend approximately $100,000 in improving its terminal facilities at Sixth and Main Streets.

MARTINEZ, CAL.—J. E. Colton, winemaker and capitalist, says that he is disposed to assist financially in promoting an electric railway from Martinez to Bay Point.

CHATTANOOGA, TENN. — The City Commissioners have granted a franchise to the Chattanooga Traction Company for rights of way over certain streets in the city.

PORTERVILLE, CAL.—The Porterville Northeastern Railroad Company plans to build a branch line from Worth to the Tulare Mining Company's mine in Tulare, Cal. A.

WHEELING, W. VA.—The Ohio Valley Electric Company has been granted a franchise to maintain and operate lines with all necessary apparatus over three routes to Benwood from Wheeling.

EAST LIVERPOOL, OHIO.—It is proposed to extend the Grandview Car line of the Tri-State Railway & Electric Company through the Maplewood, Oakmont, Bloomfield and Calcutta districts.

SAN FRANCISCO, CAL. — The Northern Electric Railway Company plans to build a branch line from Marysville to Colusa. Chapman DeWolfe is representative of the company. A.

EVANSVILLE, IND.—The City Council, of Henderson, Ky., has granted a franchise to the Evansville & Henderson Traction Company to operate a line between Henderson and Evansville. S.

MIDDLEBURG, PA.—A franchise has been granted to Loren N. Downs and associates to build and operate an electric railway along the state line road to Greencastle and on to the village of Upton.

OAKLAND, CAL.—The Oakland Traction Company has been granted a franchise for a double-track electric line along the Arlington road from the Berkeley city line to the Alameda Contra Costa line.

FOREST GROVE, ORE.—The Oregon & California Railroad Company has been granted a franchise to operate a street-car system in this city, construction work to be completed within eight months.

FRESNO, Cal.—The Fresno, Hanford & Summit Lake Railway Company plans to build an interurban electric line from Fresno to Kingsburg and Sanger. F. S. Granger and W. D. Mitchell are interested. A.

SALINA, KANS.—Five townships in Osborne and Mitchell counties have voted bonds in the sum of $2,000 a mile for the Salina, Tipton & Northern Interurban Railway to build a line from Salina to Osborne.

SPARKS, NEV.—George Hark, manager of the Reno Traction Company, announces that the company intends to build an electric line from Sparks to the mines in the Wedekind District in the near future.

LEWISTON, IDAHO.—The Homestead-Lewiston Railway has completed surveys for its new line from Homestead to Lewiston. Work will be started at once. It is understood that $10,000,000 will be expended. A.

CLARKSBURG, W. VA.—The Clarksburg & Philippi Traction Company has been granted a charter to construct a railroad from Clarksburg to Philippi, and from Craigmoor to Buckhannon. The company has an authorized capital stock of $300,000.

DECATUR, IND.—The officials of the Fort Wayne & Springfield Traction Company announce that they have secured sufficient money to build an extension to the road as far south as Geneva. Work will be begun as soon as the weather permits. S.

CHICAGO, ILL.—The Mount Greenwood & Worth Traction Company has been incorporated with a capital stock of $10,000 to construct and operate street railroads. The incorporators are Jacob S. Hovland, Herbert W. Drew and John J. Poulton.

PORTLAND, ORE.—The Valley & Siletz Railroad Company has been incorporated by H. A. Packard, F. S. Belcher, and E. V. Littlefield, with a capital stock of $300,000. The company plans to build a line from the dam on the Luckimute River to Simpson, Ore. A.

CHISHOLM, MINN.—Work is to be started at once on the electric railway connecting Gilbert, Eveleth, Mountain Iron, Chisholm and Hibbing, C. E. Thomas, Chicago, is chief engineer and Oscar Mitchell, of Duluth, is at the head of the enterprise. Bids for the power house, overhead construction and equipment will be received in the near future. C.

NEW INCORPORATIONS.

COTULLA, TEX.—The Cotulla Ice & Power Company has been chartered with a capital stock of $7,500.

ANDREWS, S. C.—The Andrews Electric Company has been incorporated with a capital stock of $10,000.

SALEM, ORE.—The Rainer Heat & Power Company has been incorporated by R. D. Nichols, R. E. Griffin, and William Chappell, with a capital stock of $1,500,000. A.

LOS ANGELES, CAL.—The Pacific Pipe Line Company has been incorporated by E. F. Scott, D. K. Gault, and M. S. Patterson, with a capital stock of $10,000,000. A.

SPRING GREEN, WIS.—The Spring Green Telephone Exchange Company has been incorporated with a capital stock of $4,000. E. G. Hood, Helen Hood, Mary Lins and Joseph Lins are the incorporators.

SAN FRANCISCO, CAL. — The Midland Counties Gas & Electric Company has been incorporated by W. G. Crittenden, Berkeley; W. A. Nunlist and Joseph J. Webb, San Francisco, with a capital stock of $1,000,000. A.

CHICAGO, ILL.—The Union Electrical Construction Company has been incorporated to engage in manufacturing and installing electrical apparatus. The incorporators are Howard M. Harpel, William H. Dietrich and Charles H. Peiger.

CHICAGO, ILL.—The Arthur McKinney Company has been incorporated with a capital stock of $25,000 to manufacture and deal in electrical fixtures and appliances. The incorporators are Arthur McKinney, Ira N. Odell and Fred G. Ricé. Z.

LITTLE ROCK, ARK.—The Guthrie-Mitchell Company has been incorporated with a capital stock of $200,000 by W. M. Mitchell, Joseph A. Guthrie, Sol. H. Johl and H. C. Locklar to engage in the manufacture of electrical supplies and machinery.

DES MOINES, IOWA.—The Perkins Electrical Company has been incorporated by Bert Perkins and L. Maud Perkins with a capital stock of $20,000. The company organizes with authority to construct, repair or manufacture electric supplies and to deal in electrical fixtures of all kinds.

CHICAGO, ILL.—The New Idea Arc Light Company has been incorporated with a capital stock of $2,500 to manufacture and deal in gas and electric lamps and fixtures. The incorporators are Leon A. Barezniak, David H. Goldsmith and Samuel Stein.

SYCAMORE, ILL. — The Nehring Insulated Wire and Manufacturing Company has been incorporated with a capital stock of $30,000 to manufacture and deal in insulated wire and electrical appliances. The incorporators are Paul A. Nehring, James W. Cliffe, Thomas M. Cliffe and Louis E. Peck.

NEW PUBLICATIONS.

PROCEEDINGS OF THE RAILWAY ASSOCIATION.—The Proceedings of the American Electric Railway Engineering Association for 1911 have been issued in the form of a cloth-bound volume, and are being distributed by the secretary. A complete report of the ninth annual convention at Atlantic City, N. J., is included. A portrait of President W. J. Harvie forms a frontispiece.

FINANCIAL NOTES.

The stock market remained practically motionless during the week ending February 10 with a diminution in interest, if interest at all were perceptible. The sales, even in the principal securities, were meager, and where these reached any volume they were attended with slight net losses. The continued cold weather has made the operation of railway lines difficult and the volume of business moving, owing to late mails and uncertain conditions, has been correspondingly smaller. In the electrical business particularly, the jobbing trade reports hand-to-mouth buying. The severe winter, however, argues well for bountiful crop conditions and the continued holding back of construction indicates that as soon as the thaw sets in, there will be a decided response upon the part of the builders.

The common stock of the United Railways & Electric Company of Baltimore will be put on a dividend basis next April. A director of the company states that the property is in splendid physical condition, and that the net receipts of the year ending December 31 justify the placing of a two-per-cent rate on the common stock.

The Federal Light & Traction Company has sold $3,000,000 first-mortgage five-per-cent gold bonds. The bankers will probably offer the bonds for subscription shortly.

Stockholders of the Dallas Electric Corporation have authorized an issue of $3,500,000 five-year five-per-cent notes, dated February 1, 1912, $1,000,000 of which are to be issued at once.

The stockholders of the Mahoning & Shenango Railway & Light Company will vote March 20 on the proposal to increase the bonded indebtedness from $10,000,000 to $65,000,000.

At the annual meeting of the Eastern Michigan Edison Company, George F. Canfield was elected a director to succeed George R. Sheldon, resigned. Other directors were re-elected.

Application has been made to the New York Stock Exchange to list $351,000 additional five-per-cent collateral-trust and first-lien bonds of 1923 of the Tri-City Railway & Light Company.

The by-laws of the Metropolitan West Side Elevated Railway Company were amended at a recent meeting of the Executive Committee, and in accordance with the amendment the annual meeting will be held on the first Tuesday in October. The fiscal year closes June 30 of each year. Therefore, the annual report will be ready for distribution at the time of the annual stockholders' meeting.

The Pacific Gas & Electric Company has filed a mortgage for $150,000,000 to the Bankers' Trust Company and Frank B. Anderson as trustee. The mortgage is dated December 1, 1911, and runs to January 1, 1942. It covers gas and electric property located in twenty-nine cities in California, and $20,000,000 five-per-cent bonds have been issued for refunding and other purposes.

At the annual meeting of the Detroit Edison Company stockholders authorized the following classification of the board of directors. To serve for one year: L. W. Bowen, Alfred Jaretzki, George R. Sheldon; to serve for two years, James Campbell, F. S. Smithers, C. A. Coffin; to serve for three years, C. W. Wetmore, Alex. Dow and E. M. Bulkley. Hitherto the entire board was elected annually.

The American Telephone & Telegraph Company has bought from Kellogg Switchboard interests 5,000 shares of Western Electric stock, at $250 per share. This purchase brings the total Western Electric holdings by the American Telephone & Telegraph to 125,477 shares, or about 83 per cent of the 150,000 shares outstanding. Negotiations are pending for the outstanding minority shares.

The Cumberland Telephone & Telegraph Company stockholders, at the annual meeting held in Louisville on February 1, approved a bond issue of $15,000,000 for improvements. New directors were elected as follows: W. T. Gentry, Atlanta, president of the Southern Bell Telephone Company: J. Epps Brown, Atlanta, vice-president and general manager of the Southern Bell Telephone Company, and U. N. Bethell, New York, vice-president of the American Telephone and Telegraph Company. Directors re-elected include J. E. Caldwell of Nashville, now president of the Cumberland Company; W. H. Woolverton of New York, John W. Barr of Louisville, James R. Robinson of Memphis, Theodore N. Vail of New York, president of the American Telephone and Telegraph Company, and president of the Western Union Telegraph Company; A. G. Sharp of Atlanta. Mr. Gentry was elected president of the Cumberland Company and Mr. Caldwell president of the board.

Dividends.

Brooklyn Rapid Transit Company; a quarterly dividend of one and one-quarter per cent payable April 1 to stock of record March 9.

Federal Light & Traction Company; a regular quarterly dividend of one and one-half per cent on the preferred stock, payable March 1 to stock of record February 15.

Old Colony Street Railway Company; a quarterly preferred dividend of one and one-quarter per cent, payable March 1 to stock of record February 23.

Rochester Railway & Light Company; a quarterly dividend of one and one-quarter per cent, payable March 1 to stock of record February 23.

Washington Railway & Electric Company; quarterly dividend of one per cent, payable March 1.

Portland (Ore.) Railway, Light & Power Company, has declared a dividend of one per cent, payable March 1 to stock of record February 12, 1912.

Marconi Wireless Telegraph Company, Limited; an interim dividend at the rate of seven per cent per annum for the half year ended December 31, 1911, payable February 1, on the cumulative participating preferred shares; also a semi-annual dividend at the rate of ten per cent per annum on the ordinary shares.

Reports of Earnings.

DULUTH-SUPERIOR TRACTION.

The Duluth Superior Traction Company has issued its report for the year ended December 31, 1911. The income account compares as follows:

	1911.	1910.
Gross	$1,135,300	$1,091,582
Expenses	608,135	604,075
Net earnings	527,165	487,507
Interest and taxes	208,161	190,779
Surplus	*319,004	296,728
Preferred dividends	60,000	60,000
Common dividends	175,000	157,500
Depreciation	58,288	54,579
Surplus	25,715	24,649

*After allowing for four per cent on the prefrered stock, the balance, $259,004, is equal to 7.4 per cent on $3,500,000 common stock.

METROPOLITAN STREET RAILWAY.

The New York Public Service Commission has issued a report of the receivers of the Metropolitan Street Railway Company for the quarter ended September 30, 1911, which compares as follows:

	1911.	1910.
Gross earnings	$3,466,105	$3,444,582
Net earnings	1,460,818	1,421,610
*Surplus	573,258	508,355

*After deducting charges and taxes. Interest permanently defaulted is not deducted.

LONDON UNDERGROUND.

The London Electric Railway Company and the Metropolitan District Railway Company report for the six months ended December 31, 1911, compared as follows:

London Electric Railway:

	1911.	1910.
Gross	£366,190	£352,895
Expenses and taxes	170,941	166,968
Net	195,249	185,927
Other income	7,109	5,166
Total income	202,358	191,093
Interest on debent., rents, reserve, etc.	104,783	102,040
Surplus	97,575	89,053
Previous surplus	14,516	12,402
Total surplus	112,091	101,455

Metropolitan District Railway:

Gross	£315,606	£305,806
Expenses and taxes	150,853	150,593
Net	164,753	150,213
Other income	49,075	45,437
Total income	213,828	195,650
Interest on debent., rent, reserve, etc.	142,613	141,155
Surplus	17,215	54,495
Previous surplus	14,276	8,527
Total surplus	85,491	63,022

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Feb. 12.	Feb. 5.
Allis-Chalmers common (New York)	1	1
Allis-Chalmers preferred (New York)	7	6
American Tel. & Tel. (New York)	140⅛	139½
General Electric (New York)	156	156¾
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	79	75
Postal Telegraph and Cables preferred (New York)	69	70¼
Western Union (New York)	84⅛	82¼
Westinghouse common (New York)	70½	70
Westinghouse preferred (New York)	*114	114
Edison Electric Illuminating (Boston)	298	297
Massachusetts Electric common (Boston)	20	21
Massachusetts Electric preferred (Boston)	93¾	94¾
New England Telephone (Boston)	159	161
Electric Company of America (Philadelphia)	11⅞	11⅝
Electric Storage Battery common (Philadelphia)	54	53¼
Electric Storage Battery preferred (Philadelphia)	54	53¼
Philadelphia Electric (Philadelphia)	18⅛	18
Chicago Telephone (Chicago)	139	137½
Commonwealth Edison (Chicago)	139	139
National Carbon common (Chicago)	105	105
National Carbon preferred (Chicago)	114	115

*Last price quoted.

PERSONAL MENTION.

FORSBECK & WETZEL, electrical and civil engineers, have opened an office at 615 Black Hawk Bank Building, Waterloo, Iowa, and will conduct a general civil and electrical business

O. M. RAU, superintendent of lighting and chief electri an of The Electric Company, Milwaukee, Wis., has been appointed general manager of the Commonwealth Power Company, Milwaukee.

H. C. EDDY, secretary of the District Railway Commission of the Interstate Commerce Commission, Washington, D. C., has been made secretary of the Washington Section of the American Institute of Electrical Engineers.

CLEMENT C. SMITH, who has been president of the Eastern Wisconsin Railway & Light Company of Fond du Lac for a number of years, has resigned his office to engage in other interests. H. F. Whitcomb, Milwaukee, succeeds Mr. Smith.

KARL H. HANSEN of The Union Electric Light & Power Company, St. Louis, addressed the Noonday Meeting of the League of Electrical Interests on February 13. His subject was "Insuring Reliability of Central-Station Service."

E. L. WEST, vice-president and general manager of the Central Colorado Power Company, Denver, Colo., has resigned to become general manager of the Connecticut River Power Company with headquarters at Fitchburg, Mass. He is succeeded by L. P. Hammond, formerly general sales agent.

ALBERT F. GANZ, professor of electrical engineering in the Stevens Institute of Technology, gave a talk on "Electrolysis" at the New England Section of the National Electric Light Association on February 9. The meeting was an electrical men's luncheon held in the American House, Boston.

C. G. YOUNG, of New York City, has been engaged to make an examination and report for a proposed electric railway system in Central America. This is due to Mr. Young's very extended experience in the electric-railway field, not only in this country but in Central and South America and other foreign countries.

WILLIS BRINDLEY, commercial manager of the Pacific Telephone & Telegraph Company, Seattle, Wash., has resigned his position with that company to associate himself with George H. Tilden & Company, bond dealers and financial agents. C. O. Meyers succeeds Mr. Brindley with the Pacific Telephone & Telegraph Company.

JOHN H. FINNEY, southern manager of The Aluminum Company of America, made an address before the Washington Section of the American Institute of Electrical Engineers on February 13. His subject was "The Work and Purposes of the Public Policy Committee of the American Institute of Electrical Engineers and Its Bearing on Electrical Development."

CLARENCE E. CLEWELL, who for the last two years has been in charge of the design and installation of the extensive lighting work at the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company, has recently been transferred to the sales department of the Electric Company and is now engaged in illuminating-engineering work in connection with Detail and Supply Department.

J. WARREN YOUNG has resigned his position as chief signal inspector of the Erie Railroad Company to take a position with the Kerite Insulated Wire & Cable Company of New York City. Mr. Young was born in New York City on November 3, 1877, and after receiving a public-school education, entered the service of the Central Railroad of New Jersey in April, 1896, as signal maintainer's helper, remaining with that company until November, 1899, when he resigned to take a position with the Delaware, Lackawanna & Western Railroad as maintainer and inspector of signals. Later he resigned from the Lackawanna Railroad and went with the New York, Susquehanna & Western Railroad to take charge of its signal work. In September, 1904, he was appointed supervisor of signals of the Terminal Di-

J. Warren Young.

vision of the Erie Railroad, and in November, 1905, was appointed signal inspector in the signal engineer's office, which position he held until January 1, 1907, when he was promoted to the position of chief signal inspector. Mr. Young has been a member of the Railway Signal Association for ten years and for the past five years has served on Committee No. 9 (wires and cables) of the Association.

KARL M. MITCHELL has resigned his position as assistant to plant superintendent of the Chicago Telephone Company, to associate himself with Thomas H. Sidley in the electric illuminating field. The business heretofore conducted by Mr. Sidley under the name of the Thomas H. Sidley Company will be continued under the name of the Sidley-Mitchell Illuminating Company. Mr. Mitchell will devote his ability and long experience to add to the reputation of the Thomas H. Sidley Company for prompt and satisfactory service.

JOHN F. GILCHRIST, president of the National Electrical Light Association, will be present at the February meeting of the New York Companies' Section of the National Electric Light Association, to be held February 19, at the Edison Auditorium, 44 West Twenty-seventh Street, 8:00 p. m. The important question of "The Public Utility Employee and His Relation to the Company and the Public," will be up for discussion and a lively and instructive meeting is expected.

JOHN M. HOOD, JR., formerly chief engineer of the United Railways and Electric Company, of Baltimore, Md., has entered suit against the Crown Cork and Seal Company for breach of contract. Mr. Hood entered into a contract with the company on January 24, 1911, to become its general manager, superintendent and secretary for a period of three years at $15,000 a year. He says he has complied with all of the provisions of the contract but had to get out because of differences with the president of the company. He will re-enter the service of the United Railways as consulting engineer.

OBITUARY.

THOMAS W. HANLEY, head bookkeeper in the Chicago office of H. M. Byllesby & Company, died Thursday, February 8, after a week's illness. Mr. Hanley had been with the Byllesby organization about two years and had advanced rapidly with that firm, of which he was a valued employee. Mr. Hanley was born in Chicago, November 7, 1877, and eight years ago married Miss Anna Mellen, of Peshtigo, Wis., who with two sons survive him. Mr. Hanley was a member of the Knights of Columbus. The funeral was held Monday, February 12, services being at the Church of Our Lady of Good Counsel. A large delegation of officers and employees of H. M. Byllesby & Company were in attendance.

DATES AHEAD.

New England Section of the National Electric Light Association. Annual meeting, Hotel Kimball, Springfield, Mass., March 21-22.

Northwestern Electric Show. Minneapolis, Minn., March 16-23.

National Railway Appliances Association, Inc., Chicago, Ill., March 18-23.

American Railway Engineering and Maintenance of Way Association. Chicago, Ill., March 19-21.

Minnesota Electrical Association, Minneapolis, Minn., March 20-22.

Iowa Electrical Association. Annual meeting, Des Moines, Iowa, April 24-25.

Iowa Street Railway Association. Des Moines, April 25-26.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

National Electric Light Association, Annual convention, Seattle, June 10-14.

Michigan Section of the National Electric Light Association. Annual convention, on board the Majestic, sailing from Port Huron, Mich., about June 21.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors Association. Annual meeting, Denver, Colo., June 17-20.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

With the Electrical Manufacturers

The Consolidated Electric Lamp Company, Danvers, Mass., calls attention in a little folder to its guarantee on all its Champion Class A incandescent lamps. These are shipped on 60 days' trial and approval.

The Pelouze Electric Heater Company and the Pelouze Scale & Manufacturing Company, of Chicago, Ill., have been combined and will hereafter operate under the name Pelouze Manufacturing Company.

The Chester Graphite Company, Chester Springs, Pa., is distributing circular No. 13 devoted to flake graphite lubrication. This gives many important considerations on the subject of lubrication in general, and modestly points out the advantage of flake graphite for this purpose.

The Robbins & Myers Company, Springfield, Ohio, has published an attractive 40-page catalog of its Standard electric fans for direct-current and alternating-current circuits. A number of handsome colored illustrations on the cover and introducing pages contrast the ancient methods of cooling with the use of the modern electric fan in the boudoir. Each of the numerous types of ceiling, desk, oscillating and exhaust fans is fully described and illustrated.

The H. W. Johns-Manville Company is moving its general offices from 100 William Street to its new building at Madison Avenue and Forty-first Street, New York City. The company has purchased a tract of over 20 acres at Finderne, N. J., where it will erect a large factory capable of supplying for many years all the demands of the eastern market for its asbestos and magnesia products and numerous electrical supplies.

The Faries Manufacturing Company, Decatur, Ill., has published catalog No. 20, dealing with Faries patent adjustable electric brackets, portables and shades. The catalog also gives a good idea of the company's extensive lines of electric, gas and combination fixtures. The entire book of 112 pages is copiously illustrated. The adjustable fixtures are made for almost every conceivable service. Most of the electroliers and brackets are specially designed for high-efficiency lamps.

The Page & Hill Company, of Minneapolis, Minn., announces that among recent large contracts for butt-treated cedar poles were orders from the Stone & Webster Corporation (to be used in the Keokuk dam proposition); the East St. Louis, Columbia & Waterloo Railway; the East St. Louis & Suburban Railway Company and the Des Moines City Railway. The fact that companies of this caliber are using butt-treated poles is taken as evidence of the economy and desirability of adopting this system.

The Beardslee Chandelier Manufacturing Company, of Chicago, has ready for distribution, catalog S-2. All fixtures ordered from this catalog can be shipped in 24 hours. The catalog comprises 224 pages and gives a very complete listing of chandeliers of every description for both direct, indirect and semi-indirect systems, portable lamps, hall lights, combination gas and electric fixtures, brackets, gas-fixture fittings, sockets, electrical and gas fixture glassware and special glass for artistic purposes.

The Best Manufacturing Company, Pittsburgh, Pa., has engaged the services of Howard W. Evans as general manager of sales. Mr. Evans is a specialist in piping materials for power plants and will have general supervision of the company's sales, order and engineering departments. The company is thus better adapted than ever to lay out entire piping systems, furnish all the piping, valves and fittings cut, fitted and ready for erection, and to take contracts for installation as well as furnishing the equipment.

The General Electric Company, Schenectady, N. Y., in bulletin No. 4907 takes up the study of the lighting of offices, banks and public buildings. This bulletin is not only beautifully printed and worthy of a place in the files of every architect, illuminating engineer or builder, but it contains some very essential information which will add to the store of the best informed on this subject. The data respecting the economy of the drawn-wire Mazda lamp in both the existing plant and in the new plant, and the comparative figures on cost of light are of definite interest and value.

The Allgemeemeine Elektrizitäts Gesellschaft, Berlin, Germany, has issued several circulars relative to its very complete line of electric heating and household devices. Among these is one showing eleven designs of electric radiators, of which eight are of the luminous type ranging from 500 to 1,000 watts; three designs of large warming stoves require from 3,000 to 6,000 watts. There are also three foot-warmers of 50, 440 and 750 watts. Another circular shows a compact electric hair-drier, a directly heated curling iron, two designs of heaters for ordinary curling irons, and a complete electric massage outfit.

The Sprague Electric Works of General Electric Company, 529 West Thirty-fourth Street, New York City, has published Bulletin No. 237, entitled, "Motor Equipments for Printing Machinery." This is probably the most complete and attractive publication dealing with electric drive in the printing industry that has yet been prepared. Its 88 pages abound with excellent illustrations of the various types of Sprague motor drive and control and typical installations thereof with both large and small printing, binding and stereotyping machinery of different manufacturers. There are also described and illustrated electric hoists for raising paper rolls to presses, ventilating outfit, generators and switchboards for power-plant equipment. A copy of this interesting bulletin may be secured by any printing house on written request to the company.

Record of Electrical Patents.

Issued by the United States Patent Office, February 6, 1912.

1,016,268. Circuit-Controlling Device. W. B. Hughes, Newark, N. J. A heat or fire alarm includes an air chamber with a diaphragm whose movement due to air expansion closes the alarm circuit.

1,016,277. Lockout Device for Party Telephones. D. W. Kneisly, assignor to Dayton Telephone Lockout Manufacturing Co., Dayton, O. An oscillatory segmental plate with a series of recesses is adapted to lock the receiver hook and prevent closure of the ringing circuit except when a magnet and pawl advances the plate to one of two special recesses, one permitting release of the hook and closing of the bell circuit and the other release of the hook only.

1,016,303. Electric Measuring Instrument. C. H. Thordarson, Chicago, Ill. Includes an electromagnet with a balanced double-arm vane arranged to swing from the inner toward the outer magnet poles.

1,016,317. Electrolier. R. B. Benjamin, assignor to Benjamin Electric Manufacturing Co., Chicago, Ill. The side arms are hinged so they may swing in a plane parallel to the support.

1,016,320. Method of Hermetically Sealing Electrical Conductors Through or Into Hard Vitreous Substances. G. B. Burnside, Renfrew, Scotland. After thorough heating the part is allowed to cool slowly to a dull red heat and then is suddenly cooled by immersion in oil.

1,016,329. Multiple-Circuit Controller. C. K. Jones, New York, N. Y. A shift bar carries a number of contacts and can be moved longitudinally in opposite directions.

1,016,384. Railway-Signal. W. P. Allen, assignor to Union Switch & Signal Co., Swissvale, Pa. A pneumatically operated semaphore has an electro-magnetically controlled valve.

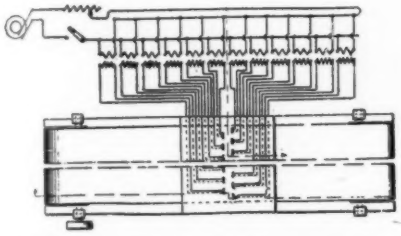
1,016,399. Ignition Device. J. F. Cavanagh, assignor of three-fourths to Lindsley & Allen Electric Co., Providence, R. I. A combined spark coil and condenser has the leads from the latter extending through the core of the coil.

1,016,401. Auxiliarized Fire-Alarm Box. F. W. Cole, assignor to Gamewell Fire-Alarm Telegraph Co., New York, N. Y. Has a signaling train actuating the alarm circuit.

1,016,430. Trolley Harp. F. E. Murphy, Lincoln, Ill. Has a rectangular frame carrying the trolley wheel and a guard device.

1,016,443. Jacket for Safety Fuses. C. N. Sachs, assignor to Sachs Co., Hartford, Conn. Consists of an integral cellular gas-dispersing structure surrounding the fuse strip.

1,016,449 to 1,016,453, inclusive. Electrical Apparatus for Destroying Insects. F. S. Smith, Philadelphia, Pa. These five patents relate to several forms of apparatus in each of which



1,016,450.—Apparatus for Electrocuting Insects.

electrodes or terminals are provided between which the insects and their eggs or larvae are passed and electrocuted.

1,016,460. Starting Mechanism for Electric Motors. J. J. Walser, assignor to Goss Printing Press Co., Chicago, Ill. Between the controller lever arm and the operating lever is a series of links, a spring and a dashpot to insure that the arm is thrown first to starting position.

1,016,467. Trolley Retriever. W. Ashcraft, Grandin, Mo. Includes a pneumatic cylinder for automatically lowering the pole, if the trolley wheel leaves the wire.

1,016,470. Motor Controller. T. E. Barnum, assignor to Cutler-Hammer Manufacturing Co., Milwaukee, Wis. Includes a number of controlling devices for starting the motor at relatively slow speed.

1,016,476. Purification of Gases. F. G. Cottrell, assignor to International Precipitation Co., San Francisco, Cal. Consists in repeatedly forming a cloud of non-gaseous particles of innoxious material in the gases, and removing, by electric charges, each such cloud together with the noxious impurities absorbed by the particles.

1,016,482. Combined Relay, Target-Setting, and Return-Call Circuit-Closing Device. E. R. Cunningham, assignor of one-third to E. B. Biegler and one-third to F. C. Tate, Des Moines, Ia. A signaling system for trolley lines controlled by the passage of the cars.

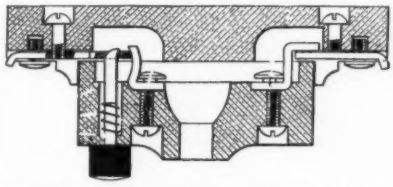
1,016,499. Electric-Clock System. R. D. Hickok, Atlanta, Ga. The primary and secondary clocks are in a single circuit including a pole-changer operated by the master clock.

1,016,524. Electric Safety-Fuse. C. N. Sachs, assignor to Sachs Co., Hartford, Conn. The fuse strip of a cartridge fuse is made of a roll of thin metal whose layers are separated by finely divided insulating material.

1,016,546. Telephone-Ringing Apparatus. W. E. Butler, David City, Neb. Includes a mercury cup with two compartments and a contact finger adapted to dip into the cup.

1,016,564. Break Key. J. L. Hogan, Jr., assignor to National Electric Signaling Co., Pittsburgh, Pa. A switch is adapted to completely separate a wireless receiving circuit from the antenna and the ground before it connects the antenna to the sending circuit.

1,016,567. Spring-Armature Relay. W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. An integral flexible-spring armature is secured to one pole.



1,016,728.—Readily Detachable Rosette.

1,016,589. Push-Button. H. C. Thomson, assignor to Electric Goods Manufacturing Co. Around the plunger is an annular distortable conductor which comes in contact with one terminal when compressed.

1,016,617. Telephone System. W. A. Fricke, assignor to Monarch Telephone Manufacturing Co., Chicago, Ill. A common-battery system with polarized ringers at each party-line station.

1,016,618. Synchronizing System. W. A. Fricke, assignor to Monarch Telephone Manufacturing Co., Chicago, Ill. An electrical system for synchronizing secondary clocks from a master clock.

1,016,646. Electric Cartridge Fuse. F. W. A. Schneider, Toronto, Canada. Has detachable plugs fitting against the ends of the fuse.

1,016,661. Circuit-Controlling Apparatus. N. Wilkinson, assignor to Allis-Chalmers Co., Milwaukee, Wis. A thermal device governed by a continued overload controls the no-voltage release magnet of a motor controller.

1,016,670. Listening-Detector for Telephone Lines. E. Burgener, Wellesley, and C. Burgener, Linwood, Ont., Canada. A buzzer is operated when another party lifts the receiver from his hook-switch.

1,016,699. Signaling Device. R. H. Manson, assignor to Dean Electric Co., Elyria, O. An electric horn adapted to produce either of two sounds.

1,016,700. Coil-Forming Machine A. L. McHugh, assignor to Allis-Chalmers Co. and Bullock Electric Manufacturing Co. A rotatable frame carrying bending blocks and anti-buckling guides is arranged for forming edge-wise-wound coils from conducting strip.

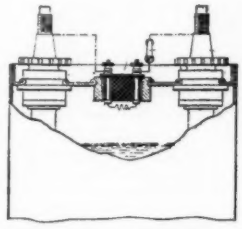
1,016,716. Electrical Apparatus for Destroying Insects. F. S. Smith, Philadelphia, Pa. A further modification of No. 1,016,453.

1,016,718. Lamp-Receptacle. J. S. Stewart, assignor to A. Stewart, New York, N. Y. Is arranged for mounting upon molding and direct connection to the molding circuit.

1,016,728. Electrical Fitting. H. C. Barber, assignor to New Haven Electrical Manufacturing Company, North Haven, Conn. A vertically movable spring latch interlocks a rosette to its base.

1,016,732. Magnetic Needle. C. L. Berger, Boston, Mass. A needle for scientific instruments has a number of twists of different pitches near each end.

1,016,747. Trolley. E. P. Hinchberger, assignor of one-third to S. Hinchberger, Pittsburgh, Pa. On each side of the wheel is a circular guard ring held in place by radial springs.



1,016,874.—Preventing Electrolyte Depletion.

1,016,751. Grinding Machine. A. B. Landis, Waynesboro, Pa. Is driven by two electric motors, one mounted on the movable bed and driving the work and the other mounted on the grinding-wheel base and driving this wheel.

1,016,753. Permeability-Measuring Apparatus. R. Leumann, Monthey, Switzerland. Includes a selenium cell and measuring circuit for determining transparency to light.

1,016,754. System of Motor Control. L. J. Lingo, Jr., assignor of one-half to R. W. Smith, Wilmington, Del. Combined with an induction motor having a normally inoperative commutator connected to its rotor is a series of switches arranged to automatically connect the commutator in a closed circuit when the current is cut off from the motor.

1,016,773. Arc-Lamp. T. J. Prisk and W. H. Prisk, Johnstown, Pa. A flaming arc with converging carbons that are fed by a system of inter-linked levers.

1,016,774. Collecting Device for Dynamo-Electric Machines. H. H. Ral-

ston, assignor to Allis-Chalmers Co. and Bullock Electric Manufacturing Co. A brush-builder for collectors or commutators has a notched lever and a tiltable device by which the force of a spring is transmitted to the lever.

1,016,777. Electric Fixture Connection. J. P. Rohan, Hartford, Conn. To an insulating joint is screwed a coupling that carries the fixture stem and has a wire-receiving opening.

1,016,780. Insulator. P. Rutzky, Crefeld, Germany. A leading-in insulator for telephone or telegraph lines has a detachable cap and an internal duct for the leading-in wire.

1,016,790. Method of Destroying Insects. F. S. Smith, Philadelphia, Pa. A further modification of No. 1,016,453.

1,016,793. Rheostat. H. A. Steen, assignor to Allis-Chalmers Co. Has a set of resistance contacts controlled by a contact arm and an auxiliary compressible resistance column which may be compressed by the arm through a cam and toggle.

1,016,794. System of Motor Control. E. W. Stull, assignor to Allis-Chalmers Co. A street-car control system with a provision to prevent putting the motors in parallel unless the master controller arranges the connections within a predetermined time after breaking the series connection.

1,016,795. Thermostatic Regulator. C. E. Teeters, Canal Dover, O. Cuts out the heating circuit of a flatiron when a certain temperature has been attained.

1,016,802. Trolley. C. F. Vensel, Jr., Chicora, Pa. The trolley harp carries two trolley wheels in tandem.

1,016,804. Manufacture of Metallic Filaments for Incandescent Lighting. H. Weber, Berlin, Germany. Consists of tungsten and tellurium, the latter within the limits of 0.2 and 1 per cent.

1,016,825. Apparatus for Producing a Constant Voltage with Variable Speed. H. Grob, Zurich, Switzerland. A storage battery in two parts is connected across a variable-speed generator, one part directly to the brushes and one is series with the shunt field.

1,016,833. Electric-Switch-Contact Holder. D. Larson, assignor to Otis Elevator Co., Jersey City, N. J. The switch has a pair of clamping jaws that can be locked together.

1,016,834. Controlling Mechanism. D. Larson, assignor to Otis Elevator Co. A compound elevator motor has an automatic controller that short-circuits the armature resistance and series field after starting and introduces resistance in the shunt-field circuit.

1,016,837. Electric-Switch-Contact Holder. D. L. Lindquist and D. Larson, assignors to Otis Elevator Co. A modification of No. 1,016,833.

1,016,847. Terminal Plate for Telephone Desk Stands. G. Nelson, New York, N. Y. The receiver hook moves a pair of contact blades.

1,016,852. Electric Program-Clock. A. L. Ronell, Fort Dodge, Ia. A motor-driven cam wheel carries a contact member adapted to close any of a series of alarm circuits.

1,016,862. Apparatus for Producing Perforated Note Sheets. F. C. White, assignor to Wilcox & White Co., Meriden, Conn. Includes electrical means for controlling the cutters.

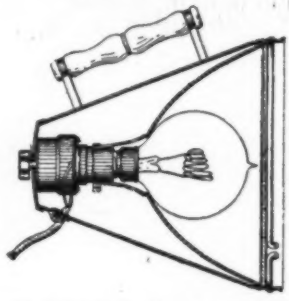
1,016,865. Alternating-Current Dynamo-Electric Machine. G. Winter and F. Eichberg, assignors to General Electric Co. A commutator motor with brushes for each set of primary poles forming a path for the currents induced by the primary field, and means for feeding magnetizing current to the rotor.

1,016,866. Alternating-Current Dynamo Electric Apparatus. G. Winter and F. Eichberg, assignors to General Electric Co. A modification of the preceding.

1,016,874. Means and Method for Preventing Depletion of Electrolyte. T. A. Edison, assignor to Edison Storage Battery Co., West Orange, N. J. Connected to storage-battery terminals is a heating circuit inside the cell which causes the hydrogen and oxygen set free during charge to recombine and form water.

1,016,875. Electroplating Apparatus. T. A. Edison, Llewellyn Park, N. J. An arrangement for plating first with nickel and then with copper without mixing the electrolytes.

1,016,882. Railway Signaling System. T. M. Freeble, Rochester, Pa., assignor of one-half to R. M. Kaufmann, Pittsburgh, Pa. An electrical block-signaling system.



1,016,887.—Portable Searchlight.

1,016,887. Portable Searchlight. H. B. Kenyon, Bedford, O. An incandescent lamp is mounted in a concave reflector within a conical shell having a socket and snap switch.

1,016,895. High-Tension Magneto Ignition Apparatus for Internal-Combustion Engines. A. M. Patton, assignor to Chambers Motors, Limited, Belfast, Ireland. A flexible driving connection between the engine shaft and magneto shaft.

1,016,919. Crossing Signal. T. A. Grist, Knox, Ind. An electrically controlled signal.

1,016,922. Railway Signaling System. L. V. Lewis and J. S. Holliday, assignors to Union Switch & Signal Co., Swissvale, Pa. A block-signal system employing alternating current.

1,016,924. Photographic Developing Apparatus. H. C. Wilcox, Hazleton, Pa. A rotatable tank is intermittently inverted by an electric motor whose circuit is electromagnetically controlled by a clock.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired February 12, 1912:

533,861. Electric Locomotive. Eben M. Boynton, West Newbury, Mass.

533,869. Conduit System for Electric Railways. Frederick S. Davenport, Jerseyville, Ill.

533,873. Alternating-Current Dynamo-Electric Machine. Axel Elkstrom, Lynn, Mass.

533,885. Apparatus for Winding Armature Coils. Henry Geisenhoener, Schenectady, N. Y.

533,893. Electrical Exchange System. George W. Hey, and Arthur E. Parson, Syracuse, N. Y.

533,902. Electrically Operated Recording Instrument for Compasses. Charles L. Jaeger, Maywood, N. J.

533,905. Distribution System for Electric Railways. Walter H. Knight, Schenectady, N. Y.

533,910. Tip for Electric Conductors. Amandus Metzger, Schenectady, N. Y.

533,920. Series-Parallel Controller. Edward D. Priest, Schenectady, N. Y.

533,926. Electric Automatic Block-System Signal. Joseph B. Stewart, Haverstraw, N. Y.

533,930. Armature Winding. David P. Thomson, Schenectady, N. Y.

533,931. Dynamo-Electric Machine. Elihu Thomson, Swampscott, Mass.

533,932. Carbon for Arc Lamps. Elihu Thomson, Swampscott, Mass.

533,936. Electric Battery. James Wells, Peoria, Ill.

533,938. Semaphore for Railway Signals. David H. Wilson, Chicago, Ill.

533,967. Combined Telephone and Telegraphic System. Christopher A. Shea, Boston, Mass.

533,979. Electrical Time Alarm. Walter Wilke, Wermeiskirchen, Germany.

534,038. Dynamo-Electric Machine. Rudolphus Fuller, Detroit, Mich.

534,028. Electric Railroad Switch. Rollin A. Baldwin, South Norwalk, Conn.

534,060. Electric Controller. George F. Card, Covington, Ky.

534,078. Regulating Device for Car-Motors or Other Electrical Apparatus. Horace F. Parshall, Schenectady, N. Y.

534,079. Armature for Dynamo-Electric Machines. Horace F. Parshall, Schenectady, N. Y.

534,083. Telephone Metallic Circuit. Christopher A. Shea, Boston, Mass.

534,084. Combined Telephone and Telegraph System. Christopher A. Shea, Boston, Mass.

534,085. Telephone Metallic Circuit. Christopher A. Shea, Boston, Mass.

534,086. Electric Arc Lamp. Thomas Spencer, Philadelphia, Pa.

534,092. Means for Mounting Dynamos on Railway Cars. William Biddle, Brooklyn, N. Y.

534,151. Alternating-Current Motor. Robert H. Hassler, Pittsburgh, Pa.

534,206. Filament for Incandescent Lamps. Thomas A. Edison, Menlo Park, N. J.

534,207. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J.

534,208. Induction Converter. Thomas A. Edison, Llewellyn Park, N. J.

534,209. Incandescent Electric Lamp. Thomas A. Edison, Llewellyn Park, N. J.

534,238. Supply System for Electric Railways. Malone Wheless, Washington, D. C.